OFFICIAL PUBLICATION OF THE PROCEEDINGS AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

VOLUME 44, NO. 13
JUNE 20, 1955

AMERICAN DYESTUFF REPORTER

Devoted to Textile Chemistry
BLEACHING • DYEING • PRINTING • FINISHING

FIRST *and foremost...*

TINOPAL BVA
TINOPAL 2BA

Tinopal BVA was designed specifically for textile application ... to produce whiter whites and brighter pastels on cotton and rayon.

The superior working properties which accounted for its instantaneous success in the mills are still unmatched—except by the more recently developed and equally successful Tinopal 2BA.

Together these are the fluorescent whitening agents most widely used in mills running cellulosic fibres. They continue to meet the consumer's taste which means they make more salable goods.

If you are not now a Tinopal user, let your Geigy representative show you why Tinopal—the *first* name in optical bleaches for textiles—is still the *foremost*.

"Tinopal" is a Geigy Registered Trademark

GEIGY DYESTUFFS
DIVISION OF GEIGY CHEMICAL CORPORATION
89-91 BARCLAY STREET, NEW YORK 8, NEW YORK

Geigy *dyestuff makers since 1859*

BRANCH OFFICES: NEW ENGLAND: NEWTON UPPER FALLS, MASS. • CHARLOTTE, N. C. • CHICAGO • LOS ANGELES PHILADELPHIA • PORTLAND, ORE. • TORONTO • IN GREAT BRITAIN: The Geigy Co., Ltd., Manchester

PERMA FIX-45

cuts color bleeding AND INCREASES FASTNESS TO HIGH TEMPERATURE WASHINGS

PERMA-FIX 45 developed by research has **proved by performance** its effectiveness in reducing color bleeding to a minimum, it increases fastness to high temperature washings. It represents a new high in achievement of fast colors on synthetics.

Perma-Fix 45 also reduces crocking—

- **increases fastness to washing and perspiration**
- **improves color fastness to wet-pressing and wet-processing**
- **effects little or no change in dyed yarns or fabrics**
- **used in combination with resins and finishes**

Dyers will like Perma Fix-45 for its **easy application — quality results — lower costs**

- **Technical Bulletin and Service available without obligation**

Refined PRODUCTS

full measure of color control

When color quality is a "must", leading dyers, finishers and printers rely on four famous A.A.P. specialties for consistently good results. Technicians from our nearest branch will be happy to provide you with working samples and explain how each can be adapted to your color problems.

LEVELENE*

Performance proved as a Leveling Agent—Penetrant—Dispersant and active Stripping Catalyzer. May be used for preparing, dyeing or finishing.

FASTOGENE*

Imparts amazing water fastness to cottons, rayons and multifibres in a simple after-treatment. Prevents wet migration. May be used after dyeing, finishing or printing.

STABILON*

For naphthol dyeing and printing. Stabilizes and prevents decomposition of Fast Color Base or Salt solutions or print pastes. Minimizes crocking and brightens naphthol shades.

DEPUMA*

Stops foam with maximum effectiveness. For dyeing, printing, or soaping. An odorless, viscous emulsion; it does not evaporate.

*Reg. U. S. Pat. Off.

AAP

ALLIED CHEMICAL PRODUCTS

50 Union Square, New York 3, N. Y.
Plant: Lock Haven, Pa.

Branches:
Providence, R. I. • Philadelphia, Pa.
Paterson, N. J. • Chicago, Ill.
Charlotte, N. C. • Chattanooga, Tenn.
Columbus, Ga. • Los Angeles, Cal.

Dominion Anilines & Chemicals, Ltd.
Toronto, Canada • Montreal, Canada

The Standard of Color Perfection

SINCE

1876

Camel

TEXTILE

Dyes

Three-quarters of a century has built the name of Camel into a symbol of dependability for textile dyestuffs—75 years of uninterrupted service to the industry as a background of experience for prompt, efficient attention to all textile dyestuff requirements and problems.

Refer your dye problems to our laboratories . . . capable, experienced engineers are ready to serve you.

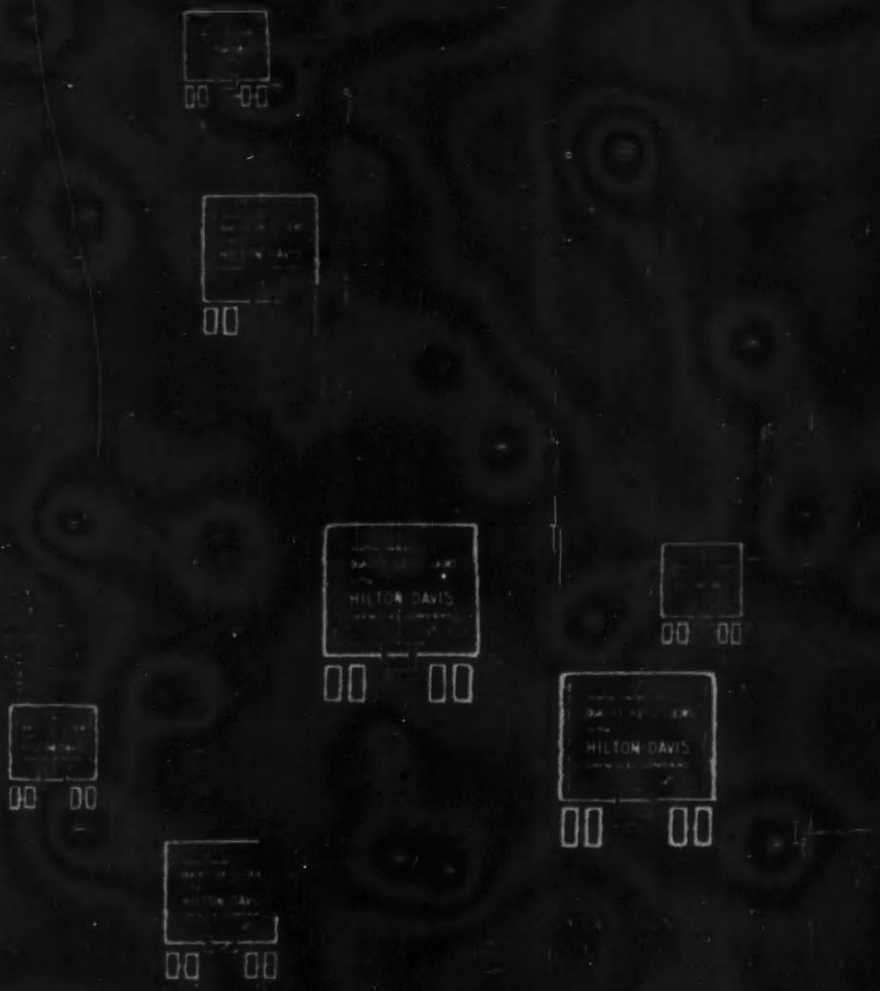
John Campbell and Company

75 HUDSON ST., NEW YORK CITY—BArclay 7-6228

2520-22 N. BROAD ST., PHILA. 32, PA.—RAdcliff 5-7103

BRANCH OFFICES & WAREHOUSES: BOSTON • EAST CLEVELAND, OHIO • ATLANTA, GA.

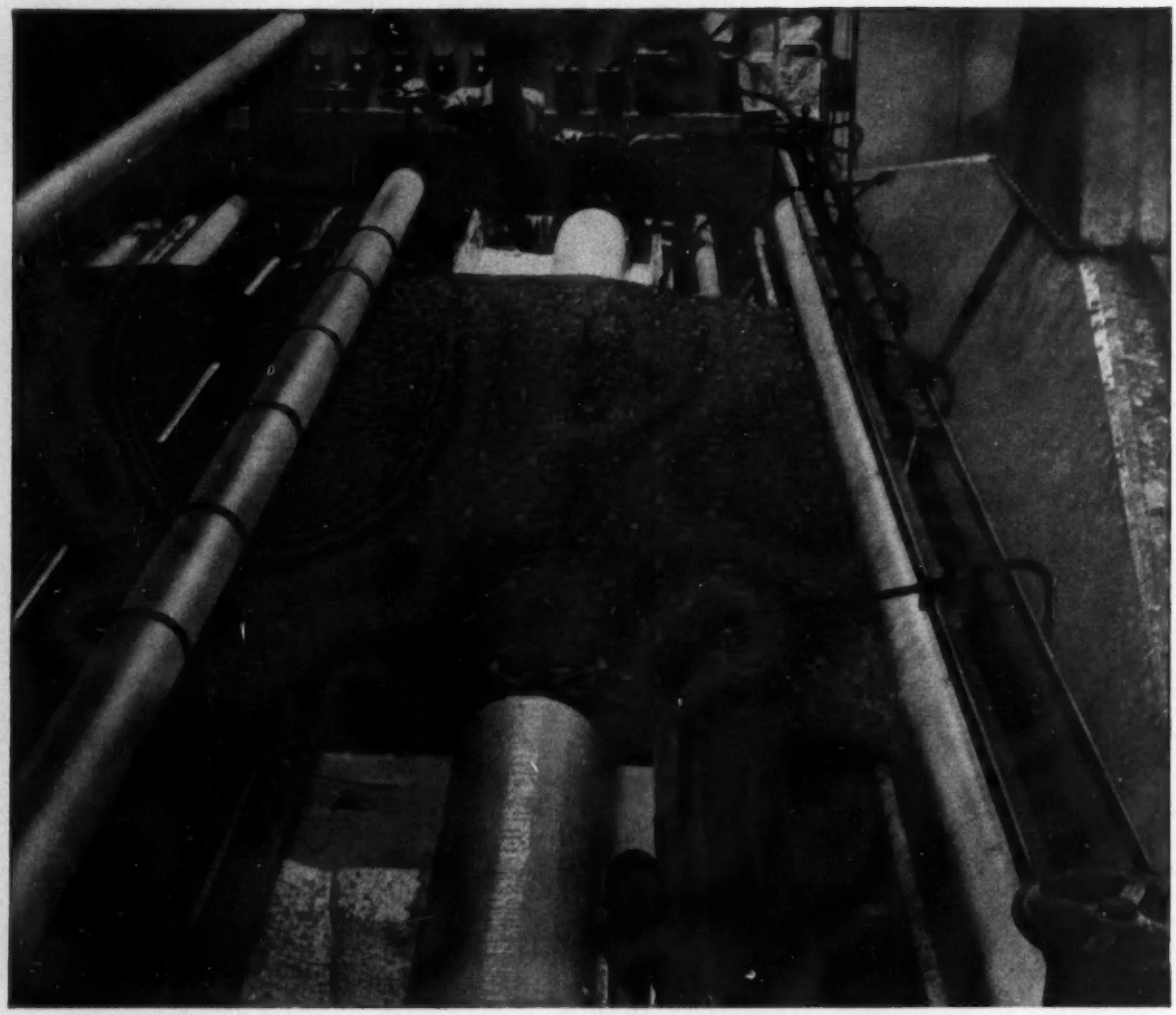
American Dyestuff Reporter, Vol. 44, No. 13, June 20, 1955. Published every other Monday. Copyright 1955, by Howes Publishing Co., Inc., 44 E. 23rd St., New York 10, N. Y. Domestic subscription, $7.50; Canadian, $8.50; Foreign, $15.00. Effective Dec. 1, 1954. Entered as second-class matter Nov. 6, 1919, at the New York, N. Y., Post Office under the act of March 3, 1879.



. . . carrying famous Hilton-Davis quality textile colors to our customers. Now, Hilton-Davis offers new, fast service with our own delivery facilities operating out of Greenville, South Carolina.

THE HILTON-DAVIS CHEMICAL CO. DIV.

2235 LANGDON FARM ROAD, CINCINNATI 13, OHIO *Manufacturers of Colors for the Textile Industry*



CARPET BACKINGS COST LESS, PERFORM BETTER WITH DRESINOL®

Carpet sizing compounds made with Hercules Dresinol reduce backing costs and materially improve wearing qualities in all types of cotton, wool, and mixed fiber carpets.

Dresinol solvent-free resin dispersions improve the "hand" of even the lowest cost carpets, provide either flexibility or stiffness as desired, improve adhesion of the backing, and increase water resistance. Dresinol is compatible with sizing compounds containing latex, starch, and pigments.

The versatility of Dresinol and its ability to aid flexibility also make it ideal in modifiers and extenders for latex-base sealers for asphalt-impregnated felt in hard-surface floor coverings.

Technical data on Dresinol are available in a recently published booklet. Write for your copy.

Industrial Chemicals—PMC Dept.

HERCULES POWDER COMPANY

INCORPORATED

993 Market Street, Wilmington 99, Del.

P185-2

Announcing . . .

Another Giant Step Forward In Kelco's Textile Development Program

KELTONE®

print paste thickener of highest viscosity

KELTONE, an extra high viscosity Kelco product for textile printing, gives top quality performance at substantially reduced costs. With **KELTONE** you prepare your print paste thickener to any desired viscosity, yet you use appreciably lower gum concentrations.

You can rely on **KELTONE**'s high viscosity shipment-after-shipment, for **KELTONE** is precisely engineered and manufactured to absolutely uniform standards.

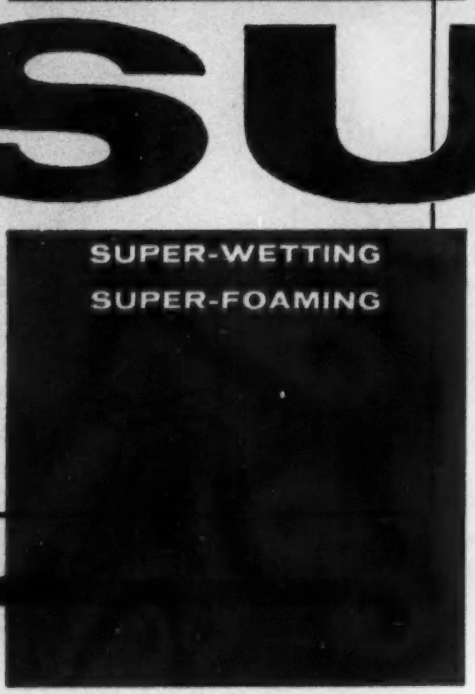
Important, too, is the fact that **KELTONE** is domestically produced, which means better dependability in your source of supply week-in and week-out, year-in and year-out.

KELTONE® a product of **KELCO** company

KELCO
DEFINED ALGIN PRODUCTS

120 BROADWAY, NEW YORK 5, N. Y.
20 N. WACKER DRIVE, CHICAGO 6, ILL.
530 W. SIXTH STREET, LOS ANGELES 14, CALIF.
CABLE ADDRESS: KELCOALGIN — NEW YORK

SUPER-WETTING



SUPR

SUPER-WETTING
SUPER-FOAMING

SUPER-WETTING
SUPER-FOAMING
SUPER-EMULSIFYING

None Better AT ANY PRICE

ONYX

the superior detergent for the textile industry

An outstanding, most efficient modified sodium alkyl sulfate, Onyx's new SUPRONYX is a product that meets a great variety of needs for quality detergency. Although mild and neutral in character, SUPRONYX is ideally suited for use in the formulation of both heavy and light duty detergents. Raw wool and worsted scouring, knit goods, rayon and acetate scouring; cotton print washing and dyeing—all these and more are natural uses for this most efficient and economical of detergency agents. SUPRONYX is easily dissolved, resistant to hard water and rinses out quickly and thoroughly. It has unimpaired foam stability and it is both gentle and non-irritating. The versatility and unusual value of SUPRONYX can only be appreciated in sample runs and from complete data. Ask for both today.

ONYX

OIL & CHEMICAL COMPANY

TEXTILE DIVISION

WARREN & MORRIS STS., JERSEY CITY 2, N. J.

CHICAGO • BOSTON • CHARLOTTE • ATLANTA

For Export: ONYX INTERNATIONAL, Jersey City 2, N. J. • *West Coast Representative:* E. S. BROWNING CO., San Francisco, Los Angeles

Wica Chemicals
INCORPORATED
DYESTUFFS • INDUSTRIAL CHEMICALS • TEXTILE SPECIALTIES • LATICES • ADHESIVES
P. O. BOX 506 PHONE FR 6-6514 OLD CONCORD RD.
Charlotte, North Carolina

Dear Jim:

Here is a snapshot of my boys. I know that you would like to see the men who solved your problems by producing that special polyvinyl acetate for your specific need. So many people have heard that we do attack each mill's problem individually and have made so many modifications in the emulsion polymers and copolymers for natural and synthetic yarns and fabrics, that we are building a new plant to accommodate the terrific demands.

I remember how skeptical some folks were when we began the individual approach. On the surface it did seem foolish. I heard so many complaints from plant supervisors and dye chemists who had tried one company after another and product after product without success, that I just had to tailor a specific product for the specific need. Now these users are certain that each product will have the same standards each time it is used. The peace of mind in this one fact means a lot, to say nothing of the actual savings.

As soon as the new plant is completed, I'll send you another snapshot. We're really proud of our progress and success that enables us to build and expand. The credit should go to you and the other mills who called on us for the answer and got the right one.

I'm looking forward to the opportunity of helping you with any other problems that you may have with your own new developments, whether in the fields of latices or resin emulsions.

Sincerely,

Bill

William Caldwell
Wica Chemicals, Incorporated

No. 25*

CIBALAN YELLOW FGL

Cibalan Yellow FGL, a pure yellow shade with extraordinary fastness to light, is the twenty-fifth member of the ever-expanding group of neutral-dyeing, pre-metallized CIBALAN dyes.

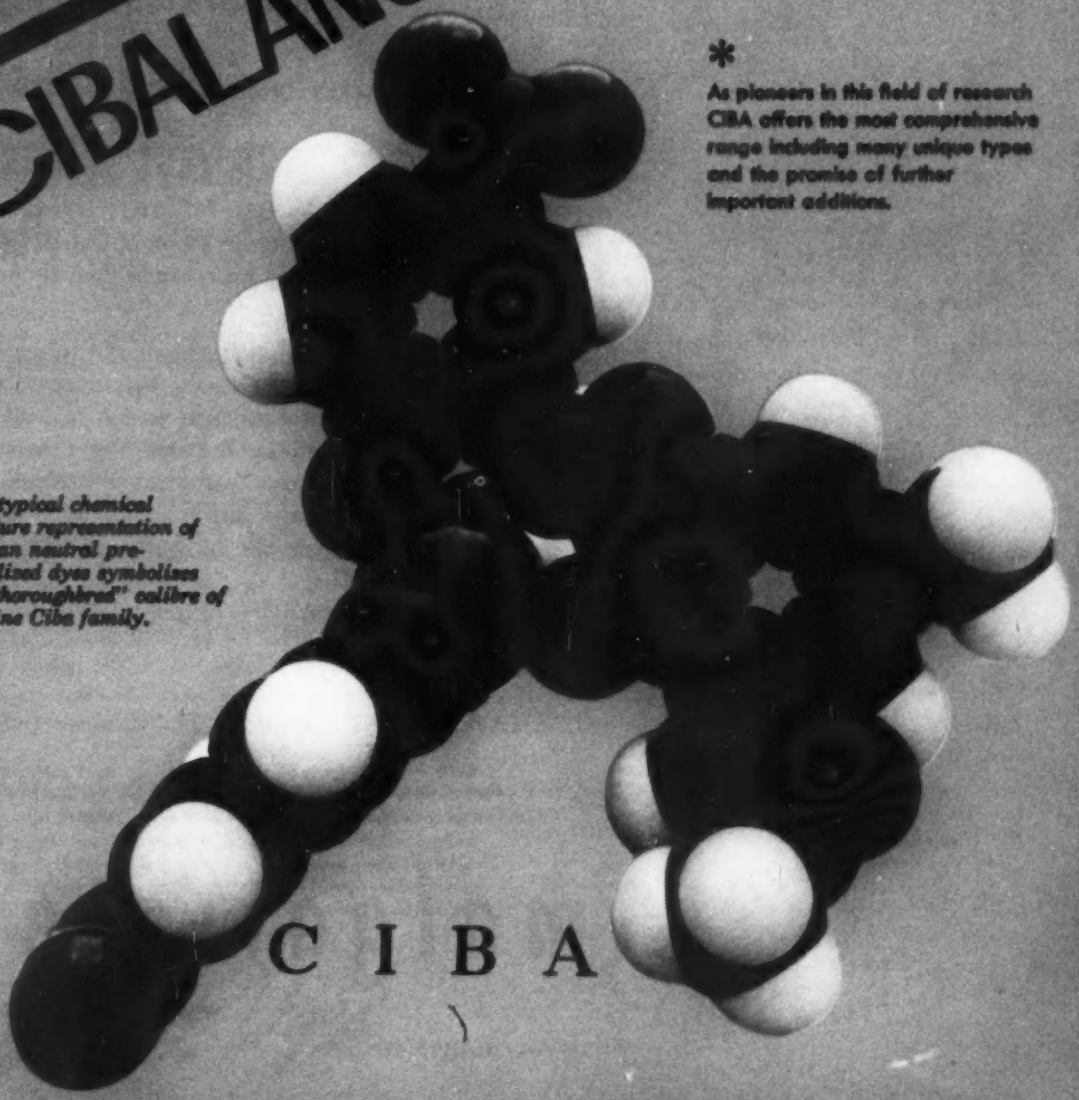
FAST SHADES FASTER!

MORE NEW SHADES!

CIBALAN'S

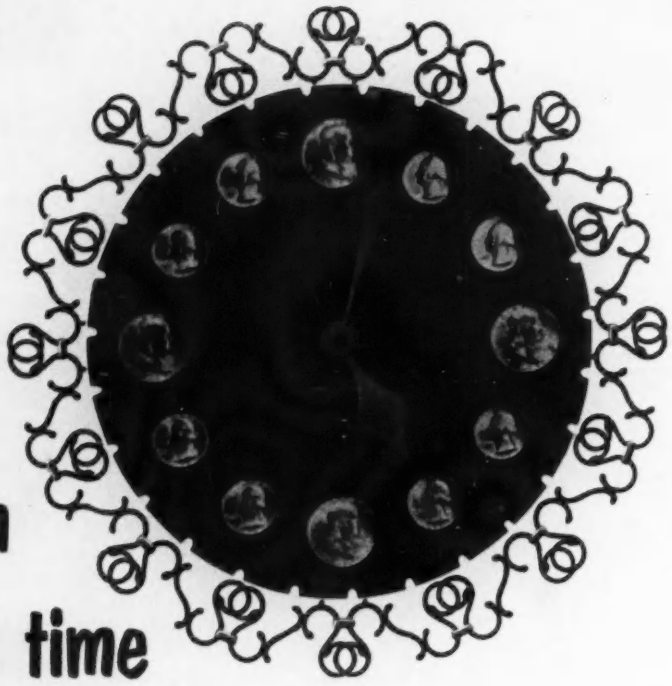
*

As pioneers in this field of research CIBA offers the most comprehensive range including many unique types and the promise of further important additions.



This typical chemical structure representation of Cibalan neutral pre-metallized dyes symbolises the "thoroughbred" calibre of this fine Ciba family.

CIBA



Out of the kettle in one-third the time

NEW ONE-BATH PROCESS SAFELY AND QUICKLY DYES DACRON

When you're dyeing Dacron and other synthetics, alone or in combination — even blended with wool — try Amalgamated's new ONE-BATH process using Dynadye-NT. You'll save time, money and get better results. For instance, blends of Dacron and wool which often take as much as 13 hours can be dyed in one-third the time when Dynadye-NT is used.

The new Dynadye-NT does not contain chlorinated solvents, many of which diffuse toxic vapors, or phenolic derivatives which may cause stream pollution. Less scouring is needed. It assures good penetration, high tinctorial value and even, bright shades. Fabrics have excellent crockfastness, withstand dry cleaning without loss of color. There's another important advantage too. Dynadye-NT may be added at any time during the dyeing cycle if additional carrier is needed.

Dye the modern way — with Dynadye-NT. Write today for data sheets and complete information.

Southern Division:
1819 Spring Garden Street
Greensboro, N. C.

Export Agents:
Tiona Petroleum Company
1015 Chestnut Street
Philadelphia 7, Pa., U.S.A.

AMALGAMATED CHEMICAL CORP., Philadelphia 34, Pa.
Ontario and Rorer Streets

Hosiery and Fabric Finishes, Dyeing Assistants and Scouring Agents
Manufacturers of the Siddon's 1-Bath Hosiery Process

Amalgamated

Du Pont developments in High-Temperature Dyeing bring you outstanding fastness, economy!

The hydrophobic properties of the new synthetic fibers created great problems for the dyeing industry. Dyers found that with fibers such as "Orlon" acrylic fiber and "Dacron" polyester fiber, duplication was often impossible... fastness standards were sometimes barely acceptable... methods proved much too costly.

One method for dyeing these hydrophobic fibers at elevated temperatures was developed by Du Pont technicians in their laboratory to help overcome these problems. But the proof of this new method had to be made in commercial dyeings. One of the early conversions to high-temperature dyeing of stock was made at the Fred Whitaker Company, where these pictures were taken. The method proved successful, not only for dyeing hydrophobic fibers, but also for wool — both in stock and yarn form.

• No matter what type of fiber you are dyeing, this new high-temperature stock-dyeing method may save you time and money, too. Du Pont will be glad to help you determine how you can adapt this method to your dyeing, or to give you specific information on the proper procedure in dyeing your fibers by this method. Get in touch with your Du Pont representative or write to: E. I. du Pont de Nemours & Co. (Inc.), Dyes and Chemicals Division, Wilmington 98, Delaware.

Du Pont Dyes

Improved results with high-temperature stock dyeing:

for **NYLON**

—the dye penetrates more quickly into the fiber, giving higher light fastness and wet fastness for the colors.

for **"DACRON"** *

—a carrier for the dye is no longer necessary, with better light fastness resulting.

for **"ORLON"** †

—dyeing time is shortened considerably, using either the cuprous ion method, or the new "SEVRON"‡ dyes which Du Pont engineered specifically for "Orlon."

for **WOOL**

—dyeing and chroming time is reduced greatly.

* "DACRON" is Du Pont's registered trade-mark for its polyester fiber.
† "ORLON" is Du Pont's registered trade-mark for its acrylic fiber.
‡ Reg. U. S. Pat. Off.

DU PONT

REG. U.S. PAT. OFF.

Better Things for Better Living . . . through Chemistry

GLASS FIBERS WITH SYTON. Yarns stay in place despite weight of cat.

GLASS FIBERS WITHOUT SYTON. Naturally slippery filaments pulled out of weave by cat.

Anchor Low-End Weaves with SYTON!

DELUSTERS AND IMPROVES QUALITY OF MANY FABRICS

Want a low sheen or a dry "worsted" hand on your fabrics? Want to "antislip" yarns without binding them together?

You can do it with SYTON, using only standard finishing equipment. SYTON is an odorless, translucent, pH-stable silica sol that works wonders with cotton, wool, synthetic fibers and filaments, and blends.

SYTON controls fabric distortion during finishing and in use. By varying the amount you can improve the hand of such materials as nylon marquisettes, rayon linings, satins, ribbons, rayon-wool blends, and glass fibers.

Monsanto Technical Bulletin No. I-110 tells all about SYTON in textile finishing. Request one from your local Monsanto representative, or write: MONSANTO CHEMICAL COMPANY, Inorganic Chemicals Division, 710 North Twelfth Street, St. Louis 1, Missouri.

Syton: Reg. U. S. Pat. Off.

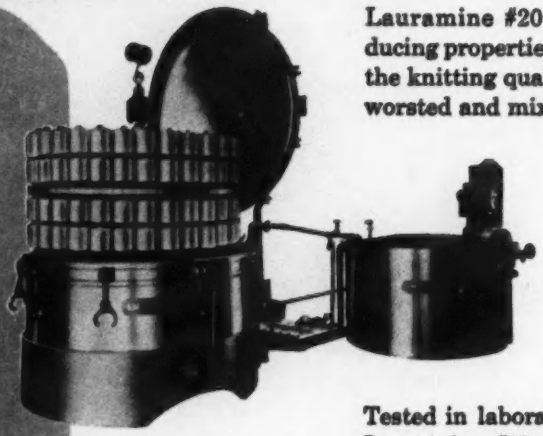
MONSANTO
CHEMICALS ~ PLASTICS

SERVING INDUSTRY, WHICH SERVES MANKIND

uniform application— greater softness for your package-dyed cotton yarns

with LAURAMINE #20

other formulae available for synthetics



The unusual softness, superior hand and body that Lauramine #20 imparts to cotton fabrics please more and more knitters every day.

Developed for package-dyed cotton yarns, Lauramine #20 is a new anionic paste-type softener and lubricator of high activity. It forms an emulsion of such fine particle size that uniform application and lubrication are assured.

Lauramine #20 has static reducing properties—will improve the knitting qualities of woolen, worsted and mixed yarns.

Tested in laboratory and mills, Lauramine #20 simplifies your finishing operations. Gives you better quality control. Increases the appeal of your fabrics. Test it out for yourself. Send today for sample and recommendations.

Soaps, Oils, Finishes

LAUREL SOAP MANUFACTURING CO., INC.

Wm. H. Bartelot's Sons
ESTABLISHED 1909
2601 E. Tioga Street, Philadelphia 34, Penna.
Warehouses
Paterson, N. J. • Charlotte, N. C.
Chattanooga, Tenn.

announcing
ahcovat
direct black PD
paste
...a new
direct dyeing vat black, especially for yarns | excellent fastness to light and weathering | excellent wet fastness, won't stain adjacent whites during laundering | outstanding pigment dispersibility | dyes packages by either pigment or reduced methods.
AHCO DYES
ARNOLD, HOFFMAN
PROVIDENCE, RHODE ISLAND
Associated with Imperial Chemical Industries Ltd.
London, England
ARNOLD, HOFFMAN & CO., INCORPORATED EST. 1815 PROVIDENCE, R. I.
Offices and Sales Service Laboratories:
Providence, R. I.
Atlanta, Ga. • Charlotte, N. C. • Teterboro, N. J.

NYANZA

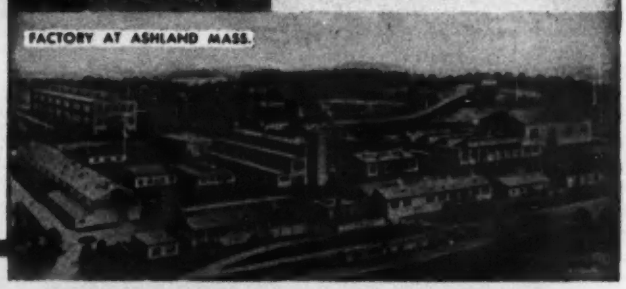
ANILINE
and
ALIZARINE
COLORS

*

TEXTILE
CHEMICALS

*

for
WOOL
COTTON
SYNTHETIC
and
MIXED
FIBERS

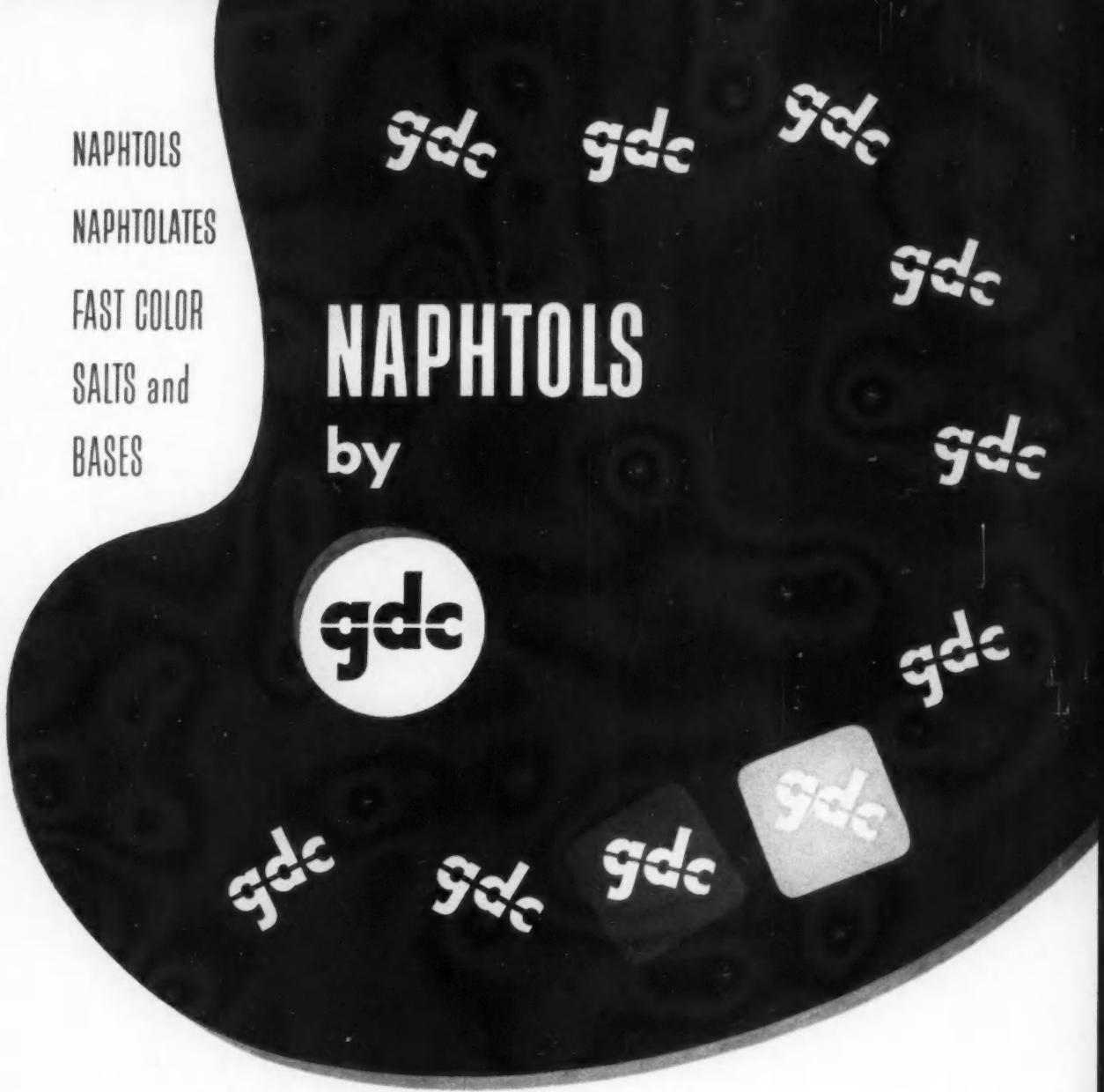


NYANZA **color & chemical company, inc.**

109 WORTH STREET • NEW YORK 13, N. Y

FACTORIES:
CHEMICAL MANUFACTURING CO., ASHLAND, MASS. NEW BRUNSWICK CHEMICAL CO., NEWARK, N. J.

BRANCHES:
349 West Randolph St CHICAGO 6, ILL. 675 Drexel Bldg. PHILADELPHIA 6, PA ASHLAND, MASSACHUSETTS 115 S.W. Fourth Ave. PORTLAND 4, ORE. 304 E. Moorehead St. CHARLOTTE 3, N. C.



Colors fast to washing...fast to sunlight

Whatever the volume of the dyer or printer—whatever his method—GDC offers the broadest range and the right combination of products to create the whole spectrum of fashion-right shades. These range from bright yellows and reds to rich deep wines, navies and browns. They are dependable allies in meeting today's ever-increasing demand for fast colors.

Years of manufacturing experience and extensive technical resources are continually at work for you—breeding new refinements into our products—creating new benefits to you. The Naphtols, Fast Color Salts and Bases are *now non-dusting* powders. Most of them offer greater ease of solubility and better stability in dyeing and printing, as well as in storage. These are all plus factors. For those who prefer to work with a prepared naphtol solution, we offer liquid Naphtolates.

Supporting every product we offer are the facilities—available to you—of our Technical Service Laboratories. We invite the opportunity to discuss the relative values of Naphtols and Naphtolates, Fast Color Salts and Bases—in terms of your particular requirements.

From Research to Reality

gdc gaf

GENERAL DYESTUFF COMPANY

A SALES DIVISION OF GENERAL ANILINE & FILM CORPORATION

435 HUDSON STREET • NEW YORK 14, NEW YORK

BOSTON • CHARLOTTE • CHATTANOOGA • CHICAGO • LOS ANGELES • NEW YORK • PHILADELPHIA • PORTLAND, ORE. • PROVIDENCE • SAN FRANCISCO

BRINE HEADQUARTERS

The great mines . . . the refineries . . . the years of teamwork with all brine-using industries . . . enable International to provide the equipment, methods and know-how to make better brine at lower cost with greater efficiency . . . in any plant . . . for any industry.

From Sterling Rock Salt or Evaporated Salt

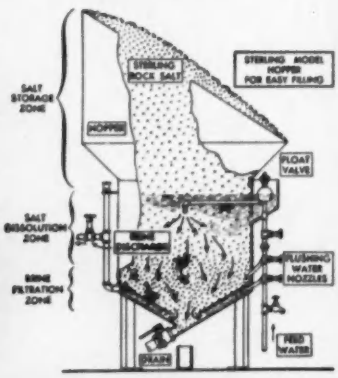
BRINE, AUTOMATICALLY MADE . . . ALWAYS SATURATED . . . PIPED TO ALL POINTS OF USE

For consultation without obligation, with a qualified International Industrial Engineer, write . . .

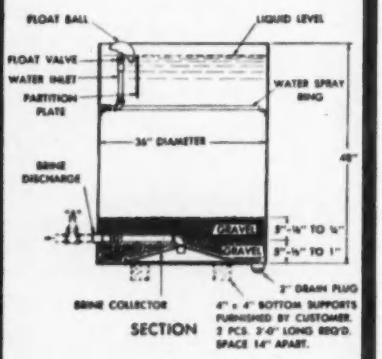
INTERNATIONAL SALT COMPANY, INC.
INDUSTRIAL DIVISION • SCRANTON 2, PA.

SALES OFFICES: Atlanta, Ga. • Chicago, Ill. • New Orleans, La. • Baltimore, Md. Boston, Mass. • Detroit, Mich. • St. Louis, Mo. • Newark, N. J. • Buffalo, N. Y. • New York, N. Y. Cincinnati, O. • Cleveland, O. • Philadelphia, Pa. • Pittsburgh, Pa. • Richmond, Va.
ENGINEERING OFFICES: Atlanta, Ga. • Chicago, Ill. • Buffalo, N. Y.

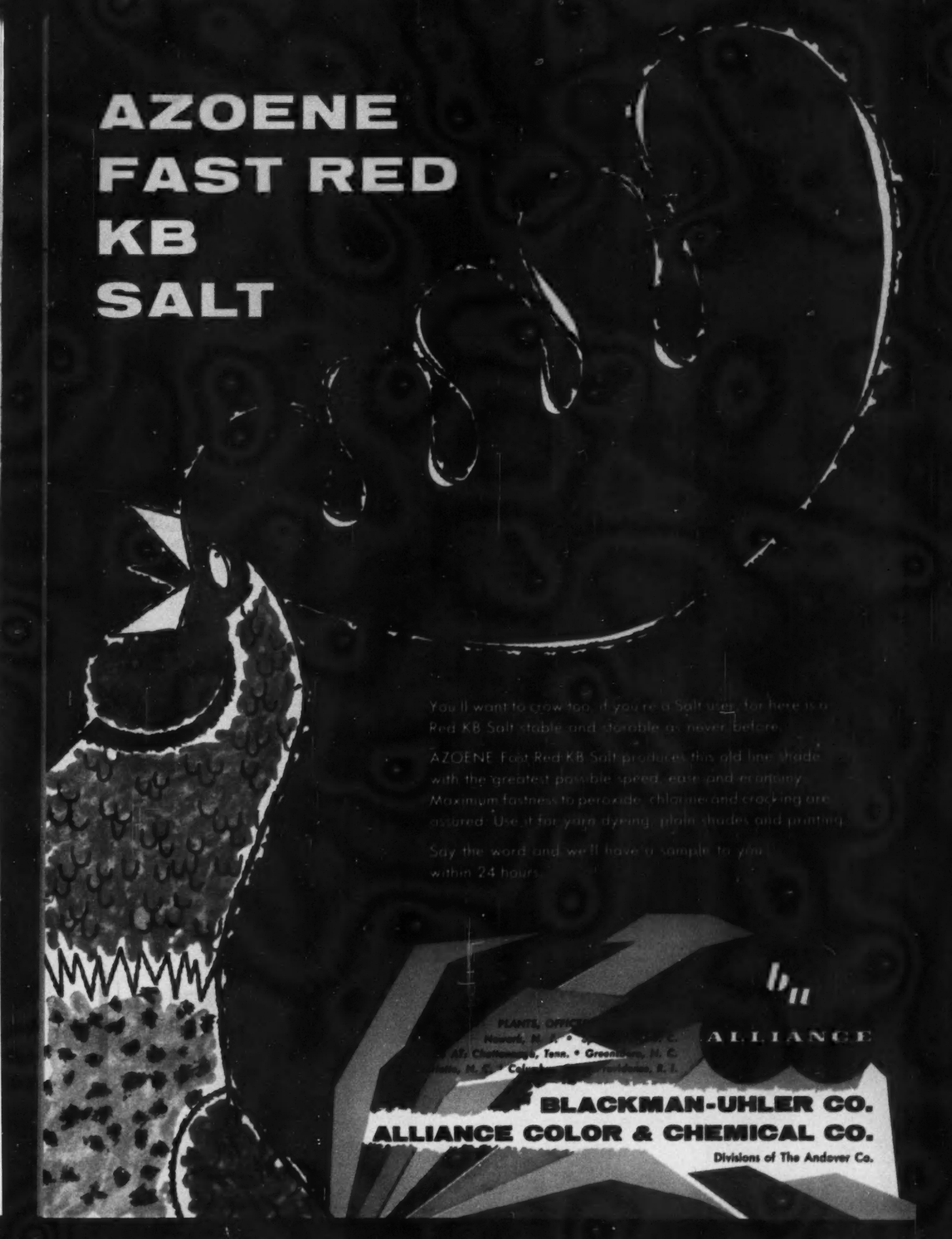
THE STERLING MODEL
LIXATE ROCK SALT DISSOLVER



THE STERLING
EVAPORATED SALT DISSOLVER



SECTION


AZOENE
FAST RED
KB
SALT
You'll want to grow too, if you're a Salt user, for here is a Red KB Salt stable and dorable as never before.
AZOENE Fast Red KB Salt produces this old line shade with the greatest possible speed, ease and economy. Maximum fastness to peroxide, chlorine and crocking are assured. Use it for yarn dyeing, plain shades and printing.
Say the word and we'll have a sample to you within 24 hours.
ALLIANCE
BLACKMAN-UHLER CO.
ALLIANCE COLOR & CHEMICAL CO.
Divisions of The Andover Co.

THE WHITEST FINISH EVER

with STANDAFIN 77

All the new synthetics—dacron, orlon, nylon and arnel—will remain white indefinitely during mill or shelf storage if finished with STANDAFIN 77.

STANDAFIN 77 is the durable, non-irritating finish that keeps white white on all synthetics without marking off. It imparts a pleasing, durable anti-static finish if you are looking for one with excellent drape and non-slip properties.

STANDAFIN 77 is a finish easily applied on conventional finishing equipment and does not require any curing if you are looking for one compatible with weighters, dullers, etc.

STANDARD CHEMICAL PRODUCTS, INC.

HOBOKEN, N. J. CHARLOTTE, N. C.

Manfacturer of Pyrotex • Standapol* • Stanteosine • Retardine* • Standafin • Stantex* *Reg. U. S. Pat. Off.

MORTON delivers any kind of salt you need—fast!

Morton makes salt for every industrial use under the sun—canning, meat packing, freeze-proofing, water softening, brine making—to mention but a few.

We can ship it to you the best possible way (roller skates are rarely used—even for small, short-distance orders) because only Morton has nine strategically located plants to serve you. And only Morton can offer fast delivery on a bag to a trainload, at favorable prices and freight, *anywhere* in the country.

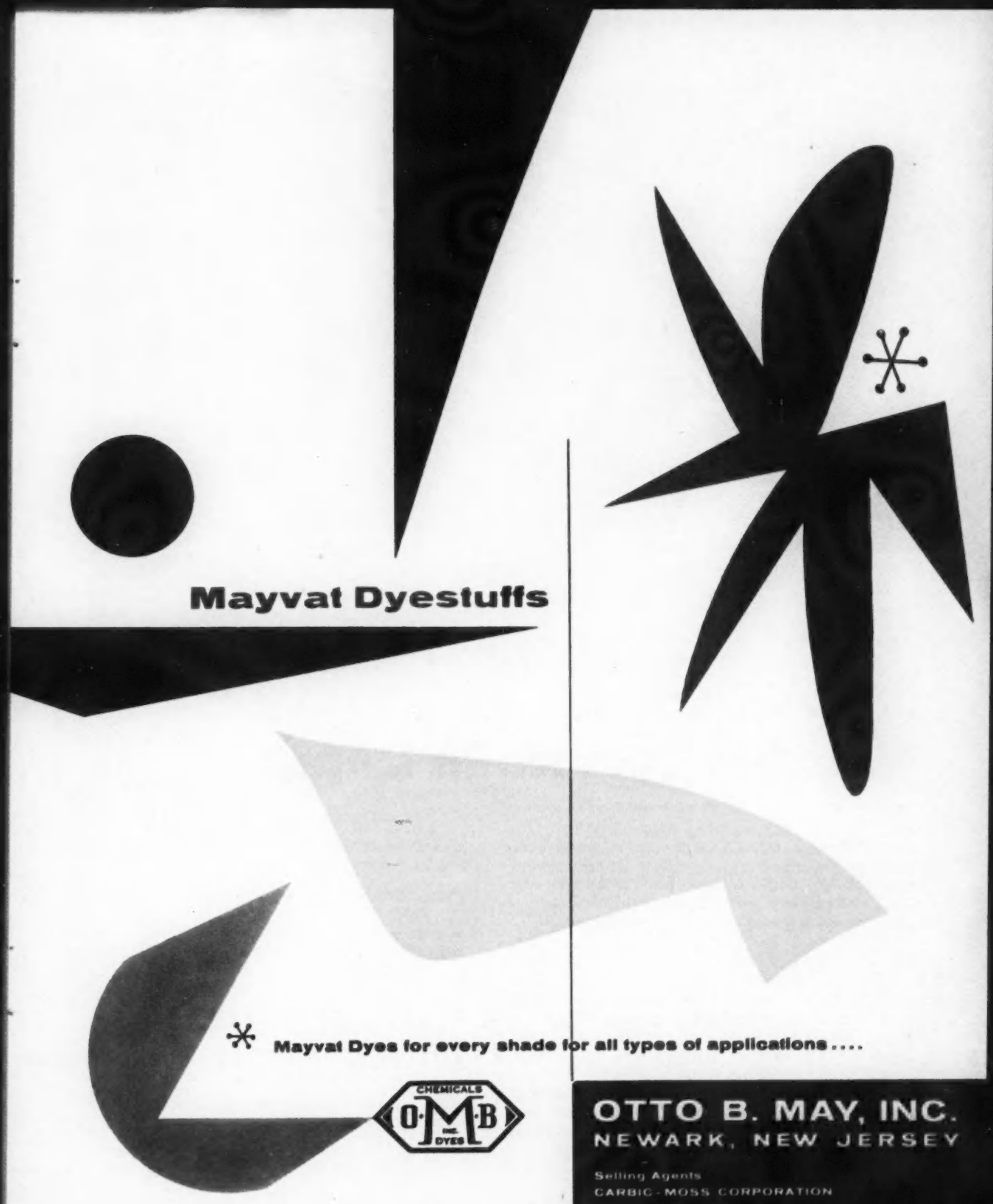
Textile Men!
If you want the right kind of advice in planning a new brine installation for your plant, or in converting an old one, call on Morton. One of our Brine Specialists will help your engineers plan the most efficient and economical installation for your particular needs.

For fast delivery of the salt you need—for expert technical help, too—write, wire, or telephone this week to:

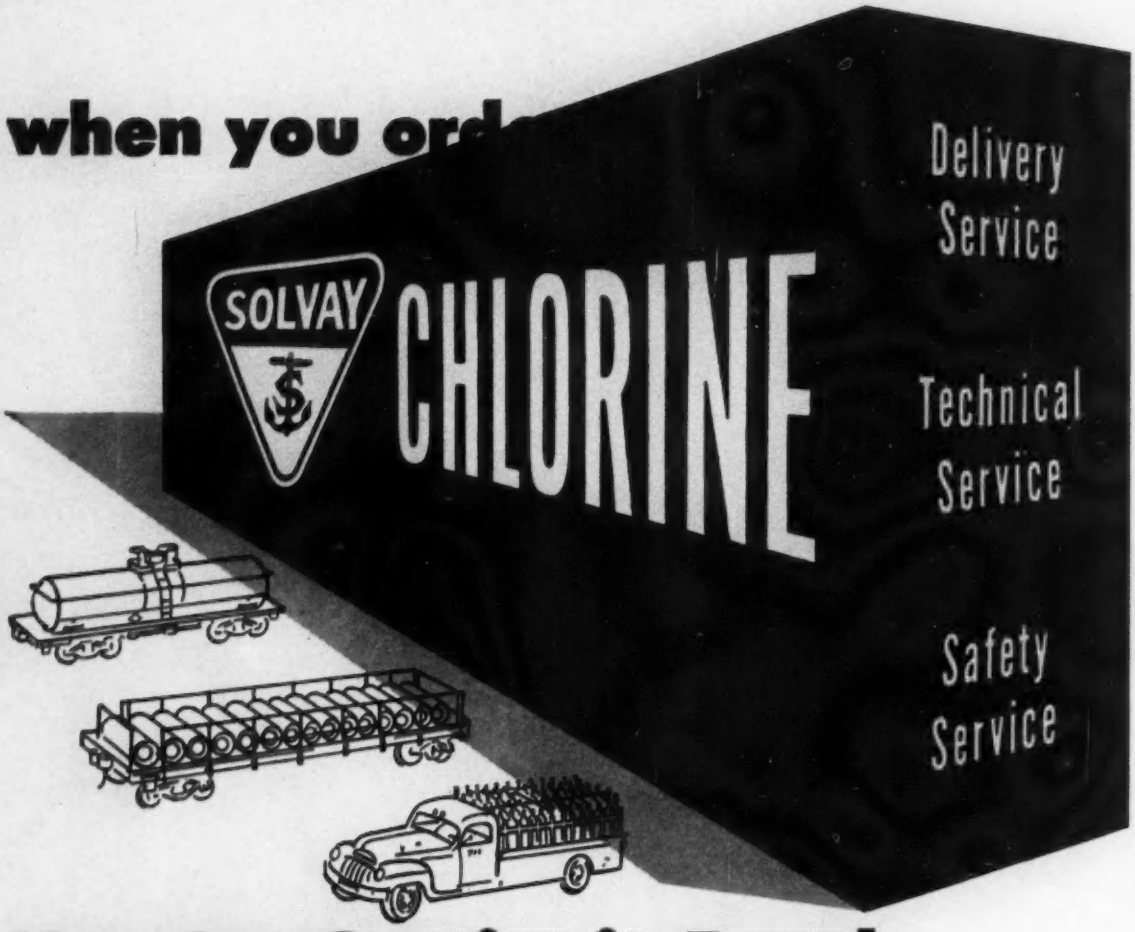
MORTON SALT COMPANY

Industrial Division, Dept. AD-6

120 South LaSalle Street, Chicago 3, Illinois • Telephone: Financial 6-1300


Mayvat Dyestuffs
Mayvat Dyes for every shade for all types of applications....
CHEMICALS
O·M·B
INC.
DYES
OTTO B. MAY, INC.
NEWARK, NEW JERSEY
Selling Agents
CARBIC - MOSS CORPORATION
Offices
2511 Lucena St., Charlotte, N. C.
451-453 Washington St., New York 13, N. Y.
BRANCHES
PROVIDENCE - PHILADELPHIA - HAMILTON, ONT.
COLUMBUS - LOS ANGELES

when you ord



You Get Service in Depth

DELIVERY SERVICE—SOLVAY'S production centers, warehouses and distribution points are strategically located to give you quick, efficient deliveries. Whether you order single unit cars or a few cylinders, SOLVAY'S *personalized service* is geared to fit your *individual needs!*

TECHNICAL SERVICE—Because SOLVAY'S Technical Service has a *separate* section that works *exclusively* with chlorine problems, SOLVAY can offer you chlorine Technical Service not ordinarily available. This *specialized* service is available without charge to users of SOLVAY Chlorine.

SAFETY SERVICE—SOLVAY has long been recognized as the leader in the development of safety programs. SOLVAY engineers were also pioneers in the development of special kits for emergency repairs to all types of SOLVAY Chlorine containers.

These SOLVAY Safety Kits may be purchased by SOLVAY Chlorine users . . . or in an emergency they may be borrowed without charge. Booklets describing these kits with detailed instruction are supplied at no cost. Also available without cost to SOLVAY customers, are Wall Safety Charts for employee instruction on safety practices . . . procedures to follow in an emergency . . . and location of nearest SOLVAY emergency kits.

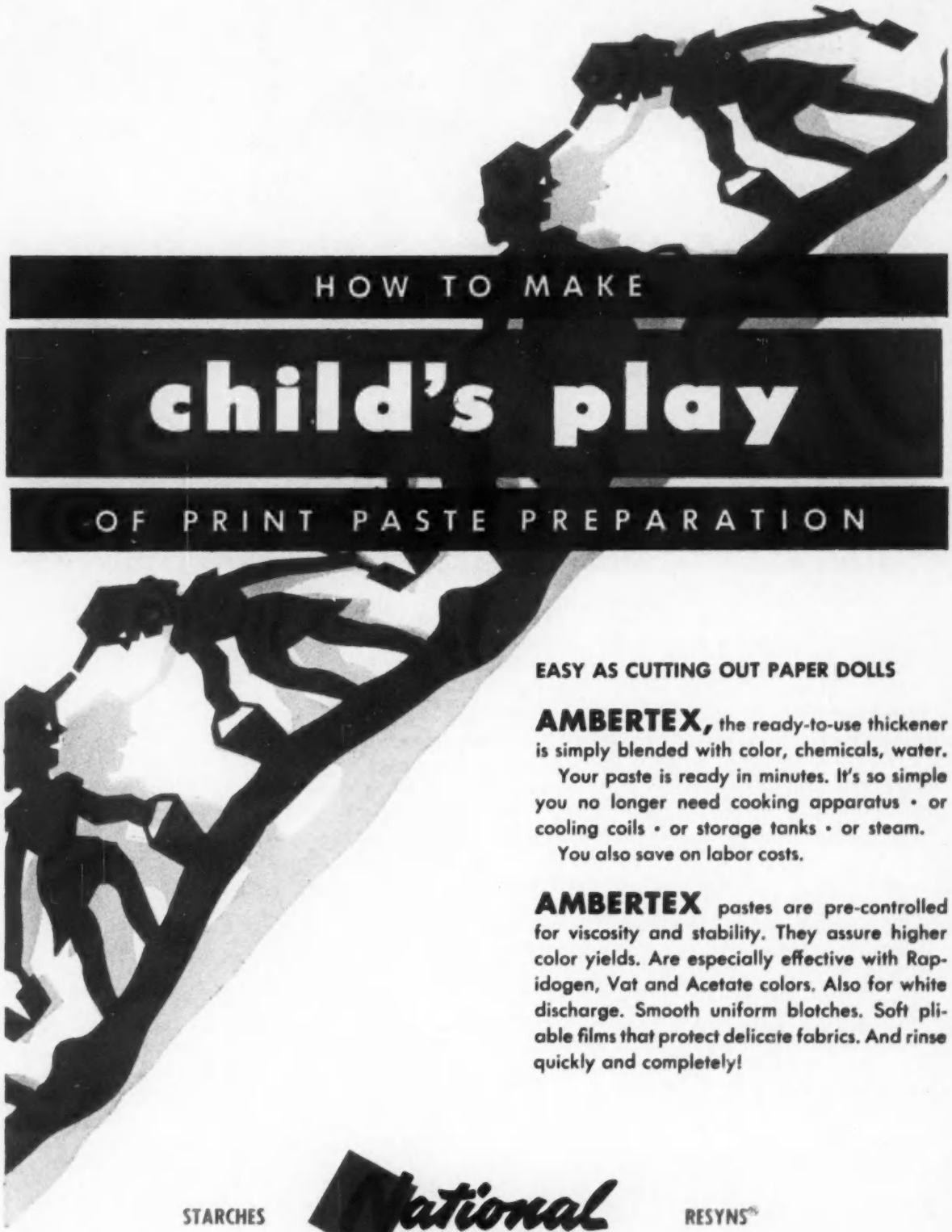
SOLVAY PROCESS DIVISION
ALLIED CHEMICAL & DYE CORPORATION
61 Broadway, New York 6, N. Y.

Allied Chemical

BRANCH SALES OFFICES:
Boston • Charlotte • Chicago • Cincinnati • Cleveland • Detroit
Houston • New Orleans • New York • Philadelphia • Pittsburgh
St. Louis • Syracuse

SOLVAY

Soda Ash • SnowFlake® Crystals • Potassium Carbonate • Calcium Chloride • Sodium Bicarbonate • Ammonium Bicarbonate
Cleaning Compounds • Caustic Potash • Sodium Nitrite • Ammonium Chloride • Chlorine • Caustic Soda • Monochlorobenzene
Para-dichlorobenzene • Chloroform • Ortho-dichlorobenzene • Methylene Chloride • Methyl Chloride • Carbon Tetrachloride



HOW TO MAKE

child's play

OF PRINT PASTE PREPARATION

EASY AS CUTTING OUT PAPER DOLLS

AMBERTEX, the ready-to-use thickener is simply blended with color, chemicals, water.

Your paste is ready in minutes. It's so simple you no longer need cooking apparatus • or cooling coils • or storage tanks • or steam.

You also save on labor costs.

AMBERTEX pastes are pre-controlled for viscosity and stability. They assure higher color yields. Are especially effective with Rapidogen, Vat and Acetate colors. Also for white discharge. Smooth uniform blotches. Soft pliable films that protect delicate fabrics. And rinse quickly and completely!

STARCHES

National STARCH PRODUCTS INC.

RESYNS®

National Starch Products Inc., 270 Madison Ave., New York 16, N. Y. • Atlanta • Boston • Philadelphia • San Francisco
In Canada: National Adhesives (Canada) Ltd., Montreal

Du Pont's more efficient scouring agent -

DUPONOL* R.A...

can improve your dyeing results with

LESS TROUBLE

LESS TIME

LESS EXPENSE

Here's how:

EXTRA-HIGH POTENCY—"DUPONOL" RA gives you the most thorough cleansing with *less* detergent. This scouring agent removes solid soils, waxes and oils quickly and effectively. *Result:* even fabrics with yarns of high twist are penetrated *completely* by dyes, following boil-off. Further, maximum detergency in most cases can be achieved at concentrations of .15% or lower!

VERSATILITY—"DUPONOL" RA reduces problems of handling, inventory, purchasing and formulating. Several mills who used this Du Pont detergent for *all* operations reported excellent results on *all* jobs. Yes, you can use "DUPONOL" RA for boil-off in preparing fabrics for dyeing; or get excellent results later, using it for scouring off excess surface dyes. You'll find fewer complaints about crocking coming in, too!

CONTROLLED FOAMING—No excess build-up to bother you with "DUPONOL" RA. What foam there is rinses away easily and quickly. And because it's liquid, "DUPONOL" RA is easier to handle, simpler to formulate. This surface active agent is water-soluble in all proportions—even *cold water!*

If you're interested in improved dyeing results, you're sure to be interested in complete information on this top-performance scouring agent. Write to: E. I. du Pont de Nemours & Co. (Inc.), Dyes and Chemicals Division, Wilmington 98, Del.

*Reg. U.S. Pat. Off.

DU PONT

REG. U.S. PAT. OFF.

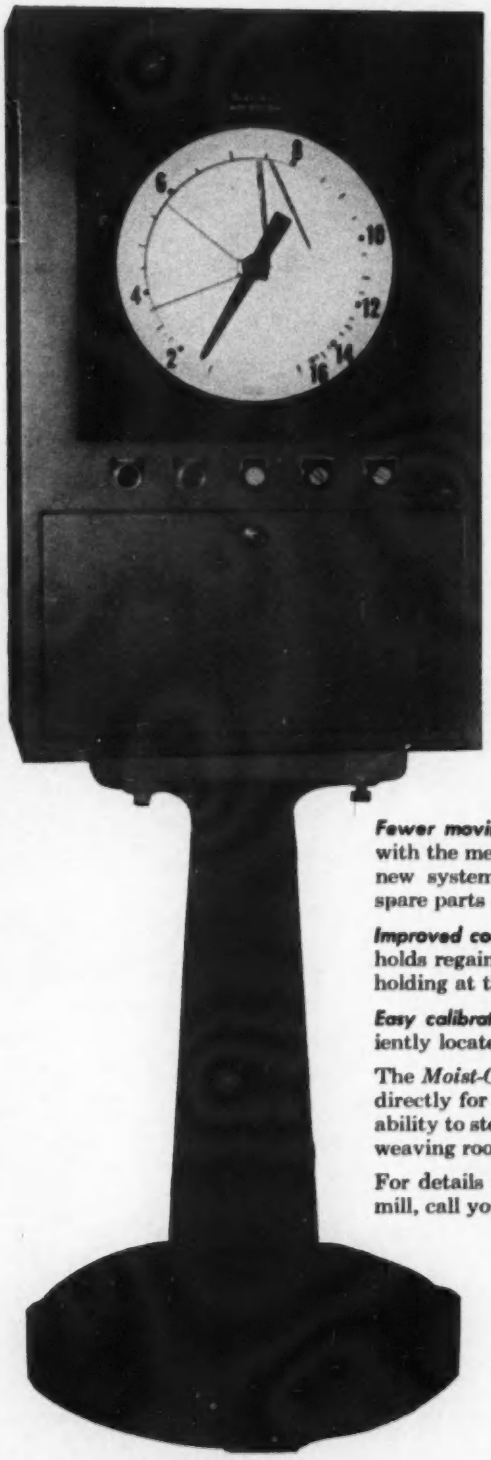
BETTER THINGS FOR BETTER LIVING

. . . THROUGH CHEMISTRY

DU PONT

DUPONOL* R.A...

SURFACE ACTIVE AGENT



READS REGAIN DIRECTLY—CONTROLS AUTOMATICALLY. *The latest improved Moist-O-Graph can help you control the slashing operation at optimum conditions. Wet or over-dried warp is eliminated . . . weavability improved.*

Improved Moist-O-Graph®

Warp regain control is now simpler, more accurate than ever before

THE latest advances in the electronic Moist-O-Graph® bring even greater refinements in sensitivity, accuracy and simplicity to the control of warp regain. A new design, embodying the most modern engineering techniques, gives you these added features:

Fewer moving parts. Simplified design makes the instrument circuit integral with the measuring circuit . . . eliminates many mechanical components. The new system is all-electronic. It's easier to maintain, and requires less spare parts stock.

Improved control. The new circuit gives closer overall control performance . . . holds regain within narrow limits. It incorporates an automatic means for holding at the set point during creeps, stops or shutdowns.

Easy calibration. Checks of calibration can be made quickly with a conveniently located switch.

The *Moist-O-Graph* takes the guesswork out of regain control. It reads regain directly for most fibers, blends or sizes. In scores of mills, it has proved its ability to step up production and quality in the slasher room, and to increase weaving room efficiency.

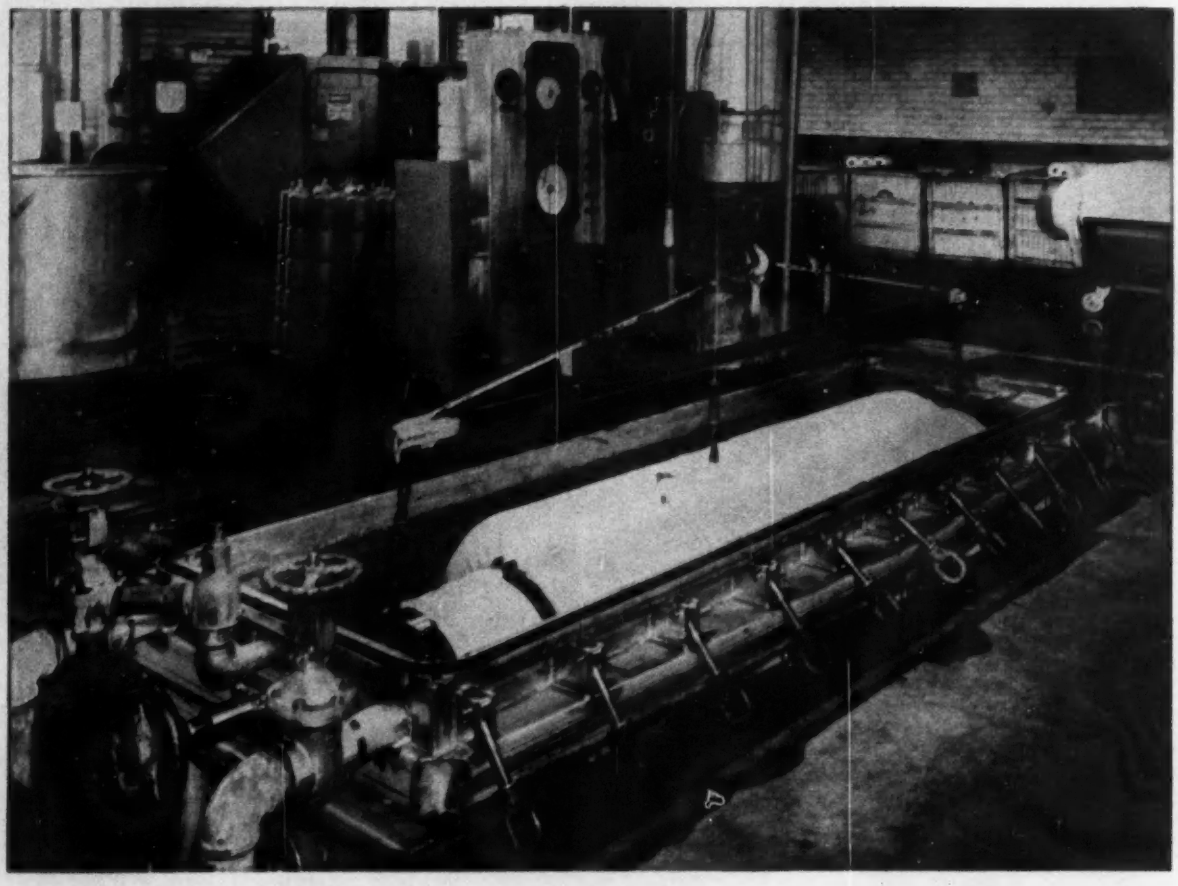
For details of how this improved instrumentation can go to work in your mill, call your local Honeywell sales engineer . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

● **REFERENCE DATA: Write for Bulletin 9306, "Instrumentation for Slasher Room Processes."**

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS

First in Controls



Taylor controlled Burlington Pressure Dye Machine installed at *Munsingwear, Inc.*

PICTURED ABOVE is a new Burlington Pressure Bleach, Boil-off and Dye machine recently purchased by Munsingwear, Inc. for use on tricot, and other knitted and open weave fabrics. With liquor being circulated through the machine at the rate of 1,500 gallons per minute the control of temperature and pressure is all important.

The Taylor Time-Schedule Temperature Controller automatically regulates rate of rise, hold time and temperature according to a predetermined ideal schedule. Pressure gages on either side of the controller indicate inside-out and outside-in pressures.

The Taylor control system saves money in at least four important ways:

1. It puts the whole process beyond the hazards of manual operation and human memory.
2. It assures a uniformly dyed product.
3. It makes possible a range of colors hitherto extremely difficult to obtain.
4. It saves labor through less material handling and shorter dyeing time.

When it comes to automatic control systems for dyeing, whether it's beam, piece, skein, package or top, Taylor engineers have the experience and the know-how based on many years of successful application in the Textile industry. Call your Taylor Field Engineer for practical advice and complete details. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

ISOLAN*

new metal complex colors

BRIGHTER

MORE SOLUBLE

BETTER LEVELING

FOR WOOL • SILK • NYLON

*Trade Mark Applied For

BAYER

DYESTUFFS INTERMEDIATES

VERONA

TEXTILE AUXILIARIES

Trademark Reg. U.S. Pat. Office

VERONA DYESTUFFS

A DIVISION OF VERONA CHEMICAL CO.

SPRINGFIELD ROAD, UNION, NEW JERSEY

Branches: Haverford, Pennsylvania · Providence, Rhode Island · Rock Hill, South Carolina

Profine wins hands down!

THE HAND OF A FABRIC HAS A LOT TO DO WITH ITS

AND COST VALUE. YOU MAY WANT IT SOFT AS A

LOFTY AS A CLOUD SUPPLE AS AN EEL VELVETY AS A

BUT THERE'S ONE THING *SURE*—YOU CAN GET A UNIQUE

WITH Profine

No other finishing agent available today can do more to give your fabrics a pleasing, saleable hand than Profine. Here is an efficient, versatile finishing agent and anti-static fiber lubricant for all types of natural and man-made fibers and their combinations. An anionic, stable chemical compound of fatty ester base, Profine is made in two convenient forms—100% active dry flakes and fast-dissolving paste.

Profine facilitates high speed sewing . . . eliminates needle burn. It is unusually resistant to oxidation, rancidity and fabric discoloration. It speeds napping . . . provides softer, loftier nap. There's no tendency toward tackiness, stiffness or mark-off on finished goods.

There's very likely a place in your mill which can profit from the superior performance of Profine. Why not test it thoroughly—and *soon?*

Profine

Procter & Gamble

TEXTILE FINISHES SALES DEPT.
CINCINNATI, OHIO

MAKERS OF OLATE, PROXOL, ORVUS AND KYRO PRODUCTS —FOR SMOOTHER TEXTILE PROCESSING.

Mathieson Quality: *everything's under control*

Prerequisite to quality chemicals is a control procedure that keeps close tab on the product stream as it flows through the plant. Pressures, temperatures, and rates of flow must be maintained within strict limits to assure chemicals that meet top specifications. The control room above helps safeguard the consistent high quality that is typical of *all* Mathieson chemicals.

In addition to quality, there are other considerations of interest to all buyers of chemicals. For example, the protection of multi-plant production facilities . . . 3 major alkali plants, 7 sulphuric acid plants, 6 caustic soda plants, 5 chlorine plants, 3 ammonia plants . . . as well as practical technical assistance with chemical handling and application problems.

Call on us when planning your chemical requirements. Perhaps you can buy to better advantage from one of America's largest producers of basic industrial chemicals.

MATHIESON CHEMICALS

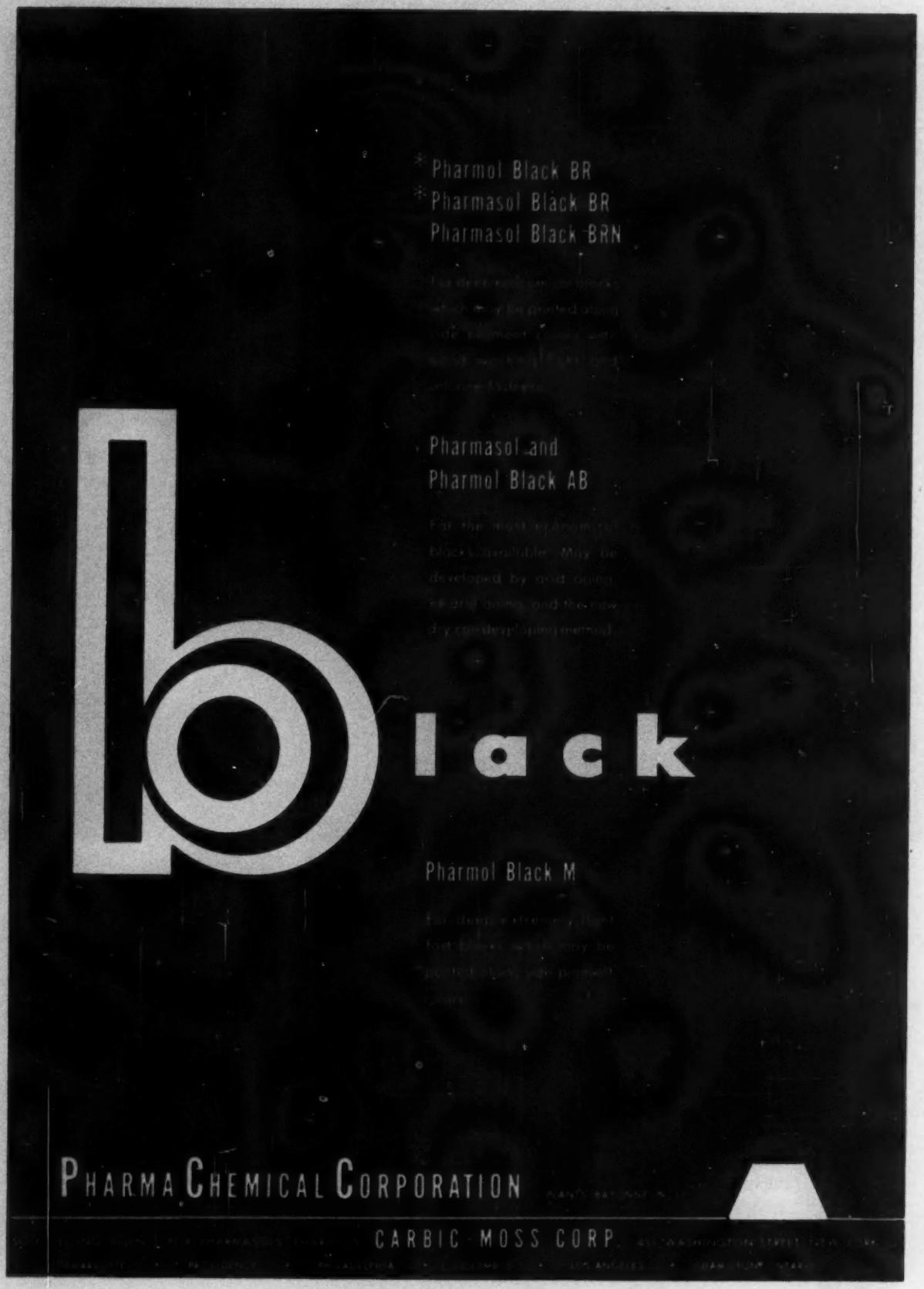
OLIN MATHIESON CHEMICAL CORPORATION

INDUSTRIAL CHEMICALS DIVISION • BALTIMORE 3, MD.

2762

MATHIESON

CAUSTIC SODA • SODA ASH • CHLORINE • SULPHURIC ACID • SULPHUR • AMMONIA • NITRATE OF SODA • BICARBONATE OF SODA • NITRIC ACID • SULPHATE OF ALUMINA • SODIUM CHLORITE PRODUCTS
ETHYLENE OXIDE • ETHYLENE GLYCOL • DIETHYLENE GLYCOL • TRIETHYLENE GLYCOL • POLYGLYCOLS • DICHLOROETHYLETHER • ETHYLENE DICHLORIDE • METHANOL • SODIUM METHYLATE • ETHYLENE DIAMINE


Pharmol Black BR
Pharmasol Black BR
Pharmasol Black BRN
Pharmasol and
Pharmol Black AB
Black
Pharmol Black M
PHARMA CHEMICAL CORPORATION
CARBIC MOSS CORP

NORMAN A. JOHNSON
Editor
CHARLES A. WHITEHEAD
Managing Editor
MYRON D. REESER
Business Manager
HERBERT A. STAUDERMAN
Advertising Manager
JAMES A. DOYLE
Promotion Manager
FRANCIS R. MURPHY
Production Manager
BERYL A. LAKNER
Circulation Manager

OFFICIAL PUBLICATION OF THE PROCEEDINGS AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

HOWES PUBLISHING COMPANY, INC.

AMERICAN DYESTUFF REPORTER

Devoted to Textile Chemistry
BLEACHING · DYEING · PRINTING · FINISHING

Contents

VOLUME 44 JUNE 20, 1955 NUMBER 13

• ***Proceedings of the American Association of Textile Chemists and Colorists***

FEATURE ARTICLES

Dyeing and Processing Elastic Nylon Hose... P413
J Vaughn Boone

The Microdyeoscope—Microscopical Observations on Dyeing..... P417
Henry E Millson

MISCELLANEOUS

AATCC Calendar P409
Activities of the Local Sections..... P409
An Open Letter to the Executives of the Textile Industry P410
Student Award Winner at FDC..... P411
Membership Applications P411
Notice to Authors of Papers..... P412

Photos:—
Western New England Section Ladies' Night P437
Philadelphia Section Outing..... P438
Rhode Island Section Ladies' Night..... P440

• ***Departments***

Book Review 441
Abstracts 442
News of the Trade..... 444
General Calendar of Coming Events..... 450

Copyright, 1955, Howes Publishing Co, Inc
Contents of previous issues can be found by consulting the Industrial Arts Index and the Engineering Index, Inc, at your library

FOR SALES IMPACT

Uninhibited Colors!

Merchandising axiom: Colors that go beyond past conceptions put sought-after individuality into fabrics!

Any color effects your stylists conceive, we can translate into practical working formulas for production runs. Month after month, we have been adding new colors to our line, expanding application laboratory facilities, re-aligning local-office operations, streamlining our warehouse and delivery services. Right now, we can serve you better than ever before.

When buying dyes, weigh all the values you receive. Remember—no dyestuffs manufacturer can offer more and better service than National Aniline—few can offer as much. It pays to call National Aniline *first!*

National Aniline Dyes

NATIONAL ANILINE DIVISION ALLIED CHEMICAL & DYE CORPORATION • 40 RECTOR ST. NEW YORK 6, N. Y.

Boston Providence Philadelphia Chicago San Francisco Portland, Ore. Greensboro Charlotte Richmond Atlanta Los Angeles Columbus, Ga. New Orleans Chattanooga Toronto

Proceedings of the

American Association of Textile Chemists and Colorists

Copyright, 1955, American Association of Textile Chemists and Colorists

Editor of Proceedings: Carl Z Draves

JUNE 20, 1955

AATCC CALENDAR

COUNCIL
Wednesday evening, Sept 21 (Chalfonte-Haddon Hall, Atlantic City, N J); Nov 18, Jan 20 (Hotel Statler, New York, N Y); Apr 20, 1956; June 15, 1956.

NATIONAL CONVENTIONS
Sept. 21-24, 1955 (Chalfonte-Haddon Hall, Atlantic City, N J); 1956 (Waldorf-Astoria, New York); 1957 (Boston); 1958 (Chicago); 1959 (Washington, DC tentative).

MID-WEST SECTION
Oct 29 (Bismarck Hotel, Chicago, Ill).

NEW YORK SECTION
Oct 14, Nov 18 (Kohler's Swiss Chalet, Rochelle Park, N J); Jan 27, Feb 24 (Hotel Delmonico, New York, N Y); Mar 23, Apr 27, May 18 (Kohler's Swiss Chalet, Rochelle Park, N J).

NORTHERN NEW ENGLAND
Oct 14; Dec 9.

PACIFIC SOUTHWEST SECTION
Oct 7, Feb 6 (Gourmet Restaurant, Beverly Hills, Calif); Dec 2.

PHILADELPHIA SECTION
Oct 21 (Penn-Sherwood Hotel); Dec 2, Jan 13 (Kugler's Restaurant).

PIEDMONT SECTION
Oct 29 (Hotel Wm R Barringer, Charlotte, N C).

RHODE ISLAND SECTION
Oct 13, Dec 1 (Johnson's Hummocks, Providence).

SOUTH CENTRAL SECTION
July 29-30 (Lookout Mtn Hotel, Chattanooga, Tenn); Dec 10 (Hotel Patten, Chattanooga, Tenn).

SOUTHEASTERN SECTION
Sept 10 (Ralston Hotel, Columbus, Ga); Dec 3 (Atlanta Biltmore, Atlanta, Ga).

WESTERN NEW ENGLAND SECTION
Sept 16 (Rapp's Restaurant, Shelton, Conn); Nov 4 (Hartford, Conn); Dec 16 (Rapp's).

Buttons bearing the insignia of the AATCC are available from the Secretary at a new price of $2.25. Pins, with safety clasp, are also available at $2.50 each. Write direct to H C Chapin, AATCC Secretary, Post Office Box 28, Lowell, Mass.

ACTIVITIES OF THE LOCAL SECTIONS

NEW YORK———The New York Section concluded its regular meeting schedule for the season on May 20th at Kohler's Swiss Chalet, Rochelle Park, N J, with a program which featured Al Kelly, prominent "double-talk" artist. Mr Kelly, a noted TV performer, was introduced to the group as Dr Albert Kelvin of Peabody State College, following an advance notice which declared that he would present some "fantastic" ideas of interest to our industry.

Raymond W Jacoby, AATCC president, spoke briefly on the passing of Walter Fancourt, and later referred to the Perkin Centennial.

P J Wood, chairman of the Nominating Committee, presented the following slate of officers, which was unanimously elected: John H Hennessey, chairman; Edmund A Leonard, vice chairman; John A Komninos, treasurer; and Norman A Johnson, secretary.

The meeting attracted 160 people with lady friends and wives of members present as especially invited guests.

* * * * * * *

PHILADELPHIA———The Annual Outing of the Philadelphia Section attracted another banner turnout on May 20th as approximately 400 members and guests enjoyed a full day's program at Manufacturer's Golf and Country Club, Oreland, Pa.

Golfing honors went to Robert C Brown, E I du Pont de Nemours & Co, Inc, who turned in a 4-over-par 75 for low gross. Joseph J Murphy, Laurel Soap Mfg Co, Inc, took first prize in the darts competition, while James E Dougherty and Albert E Stutzke, Globe Dye Works Co, garnered team honors on quoits. Top honors in pinochle went to guests John Robinson and Charles Rueter.

Ernst W Empting, General Dyestuff Co, served as outing chairman.

(Outing photos on page P438-9)

* * * * * * *

PIEDMONT———The Spring Meeting of the Piedmont Section, held April 30th at the Robert E Lee Hotel, Winston-Salem, N C, followed its usual pattern with meetings of the Section officers and the Research Committee, an afternoon technical session, and an evening banquet, the latter attracting 180 members and guests.

At the officers' meeting, work on the "Charles H Stone Scholarship Fund" was continued with the hope that it would be available to a young man attending Clemson College or North Carolina State College this coming fall.

The technical session featured papers by Joseph Brooks, E I du Pont de Nemours & Co, Inc, on "An Improved Process for Dyeing Nylon Tricot with Acid Dyes", and J Vaughn Boone, Geigy Dyestuffs Div, Geigy Chemical Corp, on "Dyeing and Finishing of Elastic-Type Nylon Hosiery".

The Civic Club Quintet of Winston-Salem supplied the musical harmony at the evening banquet, which featured John Hardin, vice president in charge of public relations, Burlington Industries, Inc as guest speaker.

* * * * * * *

RHODE ISLAND———A dinner-dance in the Ballroom of the Sheraton-Biltmore Hotel, Providence, R I, highlighted the Rhode Island Section's annual Ladies' Night Program on May 13th. John Nicol Mark, prominent after-dinner speaker, supplied the oratory, and Ralph Stuart's Orchestra, the dance music for 200 members and guests.

(Photos on page P440)

* * * * * * *

WESTERN NEW ENGLAND——Approximately 70 members and guests were present for the annual Ladies' Night meeting of the Western New England Section, which was held May 13th at the Waverly Inn, Cheshire, Conn.

Guest speaker of the evening was Robert J Holmes, General Aniline & Film Corp, who presented a talk on "Polyvinyl Pyrrolidone and Its Application".

(Photos on page P437)

An Open Letter To The Executives Of The Textile Industry

Dear Sir:

May I have a few minutes of your time to enlist your interest in and support of the AATCC? I have the presumption to do this because I can speak from personal experience.

I entered the textile industry as a chemist when there were very few people so engaged, when the value of their services was questioned, when there was no AATCC, and when exchange of information was not only frowned upon, but frequently forbidden. I served as a plant manager in the textile industry when the services of technical men were valued, when there was an AATCC, and when my company benefited greatly from the fact that many of our personnel participated in and learned from the activities of this Association.

Undoubtedly there are various times when you have direct contact with some of your contemporaries, and fully appreciate how valuable it is to you to be able to have discussions with men similarly engaged. How often has a chance remark, or an answer to an inqury provided a key to the solution of a problem with which you were concerned? Every member of your organization, no matter how humble his job, has problems which, to him, are just as important as your major problems are to you. Nothing is of greater help than direct discussions between persons who have problems in common.

It is safe to assume that you attend meetings and listen to talks by persons whom you feel can furnish good advice or suggestions. Some of them surely have helped you and thereby helped your company. Is it not logical to assume, therefore, that such participlation, extending downward through your organization will benefit it at all levels?

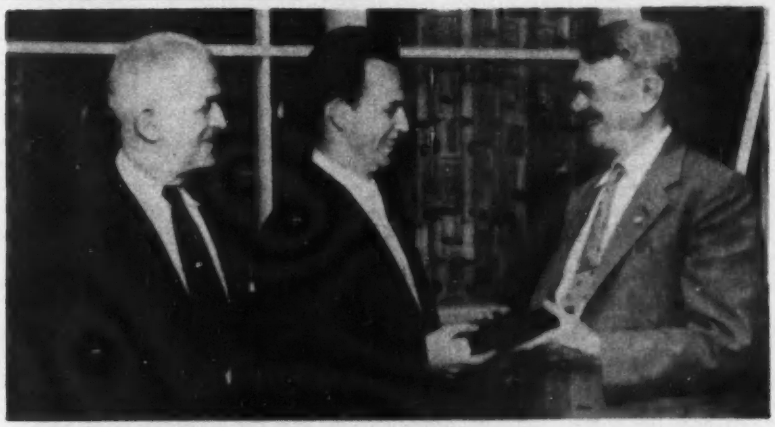
Two heads are better than one. If two men, each with a quarter, meet and exchange quarters, neither one is any better off. However, if two men, each with an idea, meet and exchange ideas, each is richer as they both have two ideas.

The fourteen local sections of the AATCC have frequent meetings at which valuable information is presented by competent people, and personal contacts made with opportunities for constructive discussions. The Association's official publication — the American Dyestuff Reporter — furnishes instructive reading every two weeks. The annual conventions provide three days of direct contact with men from all over the country, and there is presentation and review of recent developments.

From first-hand knowledge I sincerely believe that the AATCC can help you, your company and your industry. Will you prove it to yourself? You can do so by:

1 - Attending a section meeting convenient to you or a national convention.
2 - Persuading the Association members in your organization to take an active part in the Association affairs. These contacts, which provide widely diverging viewpoints, are broadening and instructive.
3 - Encouraging, and assisting if necessary, the technical men in your organization to attend the local section meetings and the annual conventions. (This year's convention will be held at Atlantic City, N J, September 22-24). The time and expense involved will, unquestionably, yield excellent returns.

Sincerely yours,
RAYMOND W JACOBY
President, AATCC



STUDENT AWARD WINNER AT FDC———**Marvin Eichenblatt (center), a senior in the textile chemistry curriculum at Fairleigh Dickinson College, is presented one of the 1955 Student Awards of the AATCC by P J Wood (right), Royce Chemical Co, honorary member of the AATCC student chapter at FDC. At left is Carl Brubaker, Standard Bleachery, Inc, a member of the Advisory Board at Fairleigh Dickinson. Mr Eichenblatt received a copy of Vickerstaff's "The Physical Chemistry of Dyeing" and a year's membership in AATCC.**

MEMBERSHIP APPLICATIONS

May 12, 1955

SENIOR

DeHaven Butterworth, Jr—Sales eng, H W Butterworth & Sons Co, Bethayres, Pa (Phil). Sponsors: E S Pierce, D Butterworth, Sr.

Cason J Callaway, Jr—Pres, Dixie Size & Chem Co, Columbus, Ga (SE). Sponsors: H G Gambert, W H Jackson.

George D Galloway—Head dyer, Beau Monde (Aust) Ltd, Moreland, Victoria, Australia. Sponsors: E I Noble, R S Mayston.

William D Graham—Chemist, P H Hanes Knitting Co, Winston-Salem, N C (Pied). Sponsors: R L Miller, Jr, L H Roane.

Sing Leong—Laboratory director, MKM Knitting Mills Inc, Manchester, N H (NNE). Sponsors: L F Ryan, S Sigel.

David Martin—Secretary, Salt Service Inc, Philadelphia, Pa (Phil). Sponsors: W H Bertolet, Jr, W H Bertolet, 3rd.

John E McLaughlin—Asst mgr text sales, E F Houghton & Co, Philadelphia, Pa (Phil). Sponsors: C B Kinney, B Menin.

Frank J Price—Asst dyer, Holston Manufacturing Co, Knoxville, Tenn (SCI). Sponsors: C E Mikels, R S Steele, Jr.

Anthony J Tokarz — Asst supt, Erwin Mills-Cooleemee Bleachery, Cooleemee, N C (Pied). Sponsors: C N Rabold, W R Wands.

Gordon A Young—Dyeing & finishing supervisor, Canadian Ind (1954) Ltd, Textile Fibres Dept, Kingston, Ontario, Canada. Sponsors: A W Boyce, K A Lister.

JUNIOR

William H Cheek—Lab asst, E I du Pont de Nemours & Co, Inc, Atlanta, Ga (SE). Sponsors: L A Burrough, W F Crayton.

Richard P Ortlip—Salesman, Salt Service Inc, Philadelphia, Pa (Phil). Sponsors: W H Bertolet, 3rd, W H Bertolet, Jr.

John F Vallone—Textile tech, Berkshire Color & Chemical Co, Delawanna, N J (NY). Sponsors: J H Hennessey, L W Gerst.

CORPORATE

Institute of Industrial Launderers
Pepperell Manufacturing Co

May 27, 1955

SENIOR

Carlos P Bolde—Supt, Perfectum S A, San Bartolo, Mexico. Sponsors: G Aboumrad, G Kohn.

Robert F Cernik—Manager, Peerless Dyers, Peerless Laundry Services, Los Angeles, Calif (PSW). Sponsor: S Springer.

Thomas Fenn—Lab mgr, Littlewoods Mail Order Stores, Ltd, Liverpool, England.

Werner E R Jacob—Plant mgr, Pellon Corp, Lowell, Mass (NNE). Sponsors: H A Wormwood, G A Collins.

Bruno Schwalbe—Chemist-dyer, Lee Dyeing Co, Lachine, Quebec, Canada (HM). Sponsors: E A Chevrette, M Fishman.

Myril C Shaw—Director of research, Asbestos Textile Inst, Philadelphia Textile Inst, Philadelphia, Pa (Phil). Sponsors: P Theel, G A Byler.

JUNIOR

L Russell Maguire—Asst chemist, Consolidated Bleaching Co, Putnam Division, Mechanicsville, Conn (RI). Sponsors: S B Sladen, J R Janket.

William A Moran—Chemical sales, American Aniline & Extract Co, Philadelphia, Pa (Phil). Sponsors: P Theel, R W Foltz.

ASSOCIATE

Paul E Wible—Plant chemist, Washington Mills Co, Mayodan, N C (Pied). Sponsors: E P Henley, W H Squier.

CORPORATE

Bellman Brook Bleachery Co (NY).
Cook-P&N Machine Co, Inc (NNE).
Haartz Auto Fabric Co (NNE).
The Jefferson Mills Inc (SE).
Morningstar-Nicol, Inc (NY).

APPLICATION FOR TRANSFER TO SENIOR MEMBERSHIP

Leander B Ricaro

STUDENT

Briungjun Park—R I School of Design. Sponsor: H B Sturtevant.

Edmond R Tucci—R I School of Design. Sponsor: H B Sturtevant.

Donald R Vermette—R I School of Design. Sponsor: H B Sturtevant.

Anthony M Minatelli, Jr — Philadelphia Textile Institute. Sponsor: W H Hughes.

Elwin C Penski—Philadelphia Textile Institute. Sponsor: W H Hughes.

NOTICE TO AUTHORS OF PAPERS

MANUSCRIPTS for the *Proceedings* and for other publications of the American Association of Textile Chemists and Colorists shall conform to the requirements and standards given in this *Notice*. Before publication, manuscripts for the *Proceedings* shall be approved by the Editor, not only for editorial correctness according to the standards of this *Notice*, but also for content of technical matter. In his work, the Editor may enlist the aid of anonymous reviewers who are selected for expert knowledge in particular fields.

It is presumed that authors in studying the comments of reviewers and of the Editor will remember that all recommendations are made in a kindly, helpful, sympathetic manner to improve the paper in both literary and technical excellence. Although authors should cheerfully consider suggestions, they are expected to defend their position if justified, especially when strictly technical matters are involved with which the authors have an intimate knowledge.

MANUSCRIPTS—Manuscripts shall be typewritten double-spaced with approximately one-inch margins on 8.5 x 11-inch white paper. In addition to the *original*, at least one carbon copy is required. Pages are to be numbered consecutively with Arabic numerals, and each page after the first shall carry the authorship at the very top. Tables and figures shall also be numbered consecutively, the tables with headings containing Roman numerals as TABLE I, TABLE II, etc, and the figures with Arabic numerals as Figure 1, Figure 2, etc, appearing *below* the figures. The names of the authors and their laboratories or business connections should appear below the title of the paper.

ARTICLES APPEARING IN THE "PROCEEDINGS" IN RECENT ISSUES OF THE "AMERICAN DYESTUFF REPORTER" will be helpful to authors as models of form for the typing of manuscripts.

LITERARY STYLE AND FORM OF PRESENTATION—In the writing of papers, authors are requested to observe a trenchant, simple style of writing directed to textile chemists and colorists with at least an elementary knowledge of chemistry, physics, mathematics, engineering, textile processes and textile machinery.

In the organization of the material, there should be one or more introductory paragraphs setting forth the occasion, significance and main objectives of the paper and of the method of attack. This should be followed by the body of the presentation, either with discussions interspersed throughout this portion or with a collected section marked "DISCUSSION" after the main body of the paper. Finally, there may be a brief section at the end entitled "SUMMARY" of "CONCLUSIONS."

Center and side headings make for easier reading. Center headings should be employed sparingly and generally will include only very important section headings, such as "INTRODUCTION," "EXPERIMENTAL," "DISCUSSION," "CONCLUSIONS," "SUMMARY," and "REFERENCES." Side headings (see third paragraph of this *Notice* for an example) shall be indented and run into the text to which they apply, and shall be separated from the paragrpah by a dash. The publisher will print center headings in bold-face capitals and side headings in capitals.

LITERATURE REFERENCES AND FOOTNOTES—References to the literature and all footnotes (except those in tables) shall be numbered consecutively with underlined Arabic numerals in parentheses at the proper place in the text. Where a reference or footnote is to be used again, the original number is simply repeated; this obviates the necessity of repeating the footnote or reference at the bottom of the page. References to the literature shall conform to the universal usages followed by *Chemical Abstracts*, which include underlining of book and journal names to indicate italicization in printing.

The spelling and rules of punctuation followed in manuscripts shall be those found in the *Merriam-Webster New International Dictionary;* abbreviations and chemical formulas shall conform to *Chemical Abstracts*. Periods shall be used only at the end of sentences, not after abbreviations.

FIGURES AND GRAPHS—Figures and graphs should be black line drawings on white drawing paper. Photographic prints are acceptable, preferably glossy prints on double-weight paper. Duplicates should be available for dispatch to reviewers. Diagrams and graphs should preferably be designed in long form to cover one column of print but may be two columns wide or the width of a full page where necessary. In graphs the frame and actual curves should be inked more heavily than the co-ordinate lines, and these latter should not be too close together. Various styles of broken lines are sometimes desirable to distinguish curves. Experimental points should be given with small plane figures, such as circles, squares, diamonds or triangles. Numbers and legends on co-ordinate axes are to be lettered in the graph by the author. Numbers and titles of figures should be placed below the diagram or on the edge of the back. Each piece of illustration copy should bear on the margin or on the edge of the back the name of the author and the title of the paper.

Photographs of authors should be included with copy, to be run in conjunction with the paper. These must be on glossy stock, and should be large enough for proper reproduction.

TABLES—Tables should not be used indiscriminately because they are very expensive to set up in type. They should be designed to be one column, two columns or three columns wide. Tables should be arranged with the view of conserving space; column headings should be short and abbreviated. Quantity designations shall never appear in the body of the table but in the headings. Tables, if possible, should be placed in the manuscript where they belong rather than separately.

SYNOPSIS—A separately written synopsis of not over 200 words containing the gist of the subject matter must accompany every manuscript.

GALLEY PROOFS—Galley proofs will be sent to the author by the publisher for correction before publication. This should not be interpreted as an invitation to rewrite the paper but rather as an opportunity to correct errors.

REPRINTS—Fifty reprints of papers published in the *Proceedings* will be furnished without charge by the publisher if requested when galley proofs are returned. These reprints are printed on one side of the sheet only and then stapled together. A schedule of prices of reprints in the usual form accompanies the galley proofs.

OWNERSHIP OF COPYRIGHTS AND PATENTS—All papers presented at general meetings of the Association or at meetings of any of its local sections and all communications shall become the property of the Association. Such papers are not to be published elsewhere until they have appeared in the *Proceedings* of the Association. Papers published in the *Proceedings* are copyrighted by the Association. Any patentable disclosures shall of course remain the property of the author or authors.

TRADE-MARKS — As the AATCC wishes to co-operate in the protection of trade-marks, it is requested that, in the body of the article, trade-mark names be written with an initial capital letter. Courtesy demands that authors include competitive products as well as those of his firm. Many current trade-mark names are to be found in the *AATCC Technical Manual and Yearbook*.

Piedmont Section——

DYEING AND PROCESSING ELASTIC NYLON HOSE*

J VAUGHN BOONE

Geigy Dyestuffs Division of
Geigy Chemical Corporation

Since the first appearance of stretchable nylon hose on the market there has been a dearth of published information regarding the various steps in processing, dyeing, and finishing this comparatively new type of textile. The author explains the manufacture of such hose from beginning to end. Conditioning, preboarding, choice of dyestuffs, and dyeing methods all come in for considerable discussion, much of which is based on direct experimental work.

INTRODUCTION

IN A relatively short time hose made from stretchable nylon yarn have become very popular. They have progressed so rapidly from a slow beginning about two years ago that they now constitute a large proportion of the total hosiery production.

From a production standpoint, several advantages are realized by the hosiery manufacturers from the use of stretchable hosiery. One of the most rewarding advantages is the convenience of not having to knit in a range of sizes. Also, since a major portion of the hose are dyed solid shades, the difficulty of keeping colored-yarn inventory is alleviated. It is a simple and most welcome innovation, despite some processing difficulties.

These difficulties are widespread in that conditions must be met in each step of manufacturing in order to exercise proper control over the finished product. One of these difficulties has been the maintenance of the proper elasticity of the yarn, which directly affects the stretch of the hose. Also, rather exact control of the length of the hose when completely relaxed is essential for appearance and pairing.

Directly associated with these two points is the setting or preboarding operation, which must be controlled so that the fabric will have a dense, full body with smooth appearance. Perhaps the most troublesome processes, however, have been scouring and dyeing, for it is in these steps that neglect of any of the essential principles of manufacturing is likely to show up.

It has been, and still is, a problem to obtain uniform shades within the same batch as well as consistency from batch to batch. Closely associated with this problem is barré effect, which is a major defect, most difficult to overcome. Also, before proper thought was given to the subject, the blocking out of one or more dyes in the formulation was troublesome.

With a realization of the problems involved, we have undertaken to learn as many of the answers as we can through research on the project. First of all, we attempted to find through experimentation the method most likely to overcome the dyeing difficulties. After this was determined, dyestuffs from the various known classes were dyed and examined in an effort to combine dyestuff properties and working methods into a harmonious union. It is felt that substantial progress has been made along these lines, and these are to be discussed under various headings.

GENERAL DISCUSSION

YARNS ——— The best known and most widely used stretchable yarn is "Helanca" nylon. "Helanca" is a registered trademark used to designate yarn manufactured under a license agreement with the Heberlein Patent Corp and produced strictly according to their specifications. The method for 70-denier is generally as follows:

> The filament yarn is given 75 turns per inch and heat-set. It is then untwisted to zero or a very low twist and plied with an end high-twisted in the opposite direction. The plied yarn is finally given a slight twist to hold the ends together.

Other yarns manufactured by other mechanical means have also appeared on the market, which accomplish the same general effect.

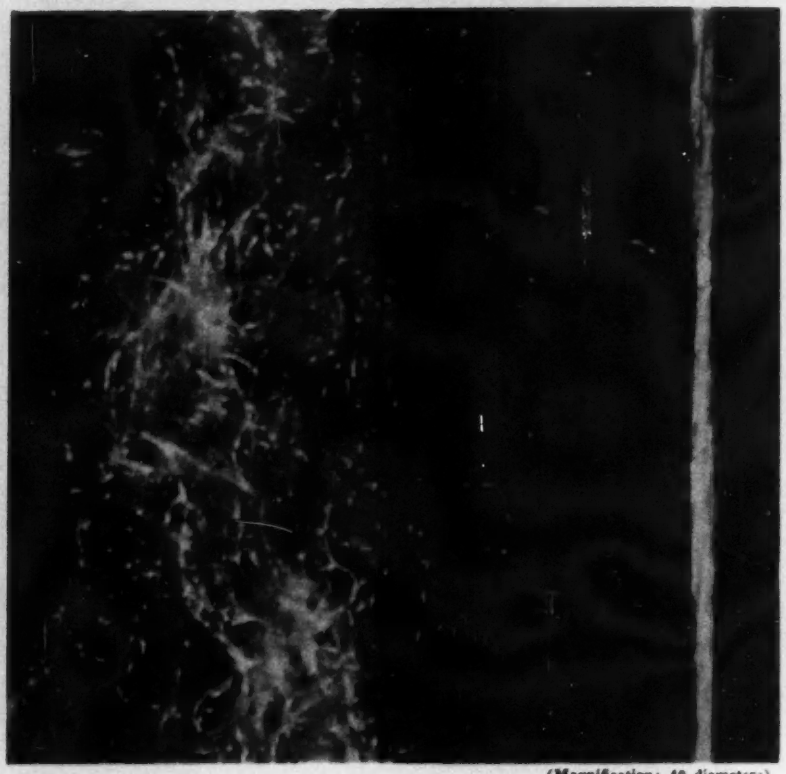
KNITTING———In order to produce a fabric having maximum stretch along with other desirable properties, several conditions should be met. First of all, the tension should be the minimum amount necessary to pull the yarn to its elongated state so that the yarn will feed into the cylinder essentially as a regular filament yarn. The loops should be increased to about double size, being so knit as to allow each filament to relax independently. A thicker or more firm fabric would indicate small loops; conversely, a flimsy fabric would result from too large loops or too fine count of yarn for the needle machine involved. It must be understood, however, that the observation must be made after complete relaxation of the yarn is accomplished.

A hose to have the proper stretch over a suitable range of sizes should be knit approximately one-half larger than the eventual wearing size of the hose. Thus, for a size eleven, or average man's size, a size seventeen equivalent would be knit. Through knitting and setting controls a size hose measuring nine inches top and foot when perfectly relaxed is obtained, this being considered standard. As a point of interest, the looping operation is considered to be much less difficult if the goods are not allowed to relax first.

CONDITIONING AFTER KNITTING ———Relaxation of the hose should take place prior to the preboarding operation. This allows the hose to fit the preboarding forms more snugly and thus permits more uniform setting. It also gives greater final elasticity to the hose, since the application of heat to yarn in the elongated state would tend to destroy the relaxability of the yarn. When sufficient time is allowed for this relaxing, no special handling is necessary. A week is considered ample for relaxation. Conditioning rooms with controlled temperature and humidity speeds up the natural process.

When it occasionally becomes necessary to process knitted hose immediately, sufficient relaxation can be achieved by subjecting the hose to a steam cloud in a rotary tub. Some have found it advantageous at this stage to give the goods a scouring operation to remove soil, grease and graphite. Since the preboarding retort has a tendency to oxidize oils, making them more difficult to remove, this practice is well worth while for goods destined for whites or pastels. This is not too time consuming, as it serves to eliminate the scouring prior to dyeing.

* Presented at the Robert E Lee Hotel in Winston-Salem, North Carolina, on Saturday, April 30, 1955.



(Magnification: 40 diameters)

Figure 1

A comparison of Helanca stretch nylon yarn (left) and regular filament nylon

PREBOARDING———Some variation in opinion is found concerning the best preboarding procedures. Preboarding for sizes 10-13 of men's hose is done on size 11 forms in some plants and in others on size 12 and 13 forms. The old adage, "What works is good", would seem to apply here.

A study was made to determine the best temperature for preboarding. Hose made of 70/2 were subjected to preboarding at 10-degree intervals from 210 to 250°F for a 3-minute cycle in a Turbo Machine. By careful observation of the results it was determined that 230°F was the critical temperature, above which the stretch was materially reduced. A temperature of 220°F to allow a safety margin was then adopted with good results. Additional trapping of the steam line was deemed necessary to give a dry steaming effect. This was found to be especially necessary with hose having tinted or dyed acetate decorative effects, for the steaming often makes the tint difficult to remove or, even worse, the tint migrates onto the undyed portion.

Special steaming adaptation at times has been found necessary to give uniform setting. As an example, on a double-tiered set of boards it was found that the top boards took more dye than the bottom row, and this caused shaded lots. This was traced to the preboarder after everything else had been eliminated. Fitting the machine with an additional steam inlet to give more uniform temperature and humidity within the retort overcame this difficulty.

Of late, experimentation has been undertaken with only one boarding, this being a final boarding, in the pressure retort, of hose *after* dyeing. One of the chief drawbacks to this technique is that few plants are equipped with retorts which complete the drying cycle. Some goods have been shipped without complaints which have been boarded on regular internally heated forms only after dyeing. This method is used, however, only when the hose are individually packaged in a rolled condition in Cellophane wrappers. For high-quality work, this method is not usually employed or recommended.

The relatively new practice of using cardboard inserts is interesting to many hose producers and is increasing in popularity. Originally only one hose was put on an insert, but of late two types of forms have appeared on the market designed for putting one pair of hose on each insert. The goods in this case are preboarded as usual with final boarding being done on the inserts. This serves a dual purpose in that it supplants the usual final boarding, serving as final inspection as well as eliminating the pairing operation. An over-all saving of plant time and labor results. The cardboard inserts are allowed to remain in the hose and are shipped to the retailer in a form easily and attractively displayed.

SCOURING———Clean goods are a prerequisite to good dyeing. Many of the defects thought to be variations in the yarn can be traced to foreign matter on the yarn affecting the dyeing affinity. It is of course realized that variations do exist in the yarn from one short span to another as well as between different merge numbers. Not only is it necessary to clean up the goods well for good dyeing, but it is also advisable to remove sizes and lubricants so as to prevent the individual fibers from adhering and thus impairing the stretch of the final product.

The fact that the yarn contracts physically to trap any foreign matter added in the setting of oils and sizes in the preboarding retort makes the goods more difficult to cleanse. For proper cleansing, a number of new products have been brought on the market. They usually follow two types: one is solvent plus scouring compound; the other is oxalic acid plus a detergent that acts in an acid medium. Both types have been known to give creditable results. It is not our purpose to evaluate these products, as this would entail a separate study involving the retarding action on the dyestuffs themselves.

This retarding effect is mentioned, for it is common knowledge that many of the currently used scouring and wetting agents have a marked retarding action on acid dyestuffs. Of late the writer has been able to take effective advantage of this retarding property to achieve level dyeing.

The procedure is to scour the goods in neutral or slightly alkaline solution at 185°F for 15 mins with ½% of an amine condensate. To the same bath is added enough acetic acid to lower the pH to about 5. The scour is then continued for an additional ten minutes. With the addition of acid, the amine condensate becomes cationic and therefore substantive to the nylon. It tends to exhaust on that portion of the nylon which would normally dye most readily, setting up at these places a slight resisting action, the end result being more even dyeing. The amine condensate reduces internal friction through its lubricating properties, which persist because it is not free-rinsing in cold water. More information will be given concerning this procedure under the discussion of dyeing methods.

The above scouring method would apply to goods destined to be dyed with such acid dyes as Polar Brown 2GL or Azo Rubinol 3GP, which require a slightly acidified bath for exhaustion. It would not be recommended for use with acetate (disperse) dyestuffs or with the more nearly neutral-dyeing milling types of dyestuffs, such as Alizarine Cyanine Green. An alkaline scour with a good detergent plus ½% soda ash for 20 mins at 185°F is usually sufficient for these types of dyes. A warm, rather than a cold, rinse in these cases would be recommended.

DYEING———In our search for the proper level-dyeing dyestuffs to use, it was quickly established that the faster dyestuffs, having poor migrating properties, were unsuitable as they tend to accentuate yarn differences. It was also observed that dyestuffs which exhaust at lower temperatures tend to reflect irregularities much more than those exhausting at higher temperatures. Therefore, dyestuffs that exhaust at higher temperatures and have good migratory properties are most desirable. Those types show up best which give maximum exhaustion without acid, the rate of exhaustion being controlled with temperature.

Even carefully selected dyes, however, do not necessarily work well in combination. This is especially true for tertiary shades, such as greys and charcoals, because blocking action may be set up by the dye possessing the fastest strike. When this happens, the dye slowest to exhaust may be held back in the bath. When this latter dye is then forced on by a lowering of the pH, it may color only the surface. Such surface dyeing is termed "riding the ribs".

Many companies working independently have very closely agreed on the existing dyestuffs that perform best on elastic nylon. It was most gratifying to check with one of the largest producers of "Helanca" yarn to find that they had compiled information from most of the major dyestuff companies. Our lists, oddly enough, were very similar. Several of these dyes are not included herein because they lacked the property of leaving acetate clean. Typical formulations would be as follows:

Dyestuffs for pastel colors where no acetate is to be left white:

Maize	Acetate Yellow G, Pr 242
Light Blue	Acetate Blue FF, Pr 228
Pink	Acetate Scarlet B, Pr 238
Mint	Acetate Yellow G Acetate Blue FF

Dyestuffs for pastel and dark shades where acetate must be left clean:

Maize	Polar Yellows, CI 642
Tan	Polar Brown 2GL, no CI no. Erio Anthracene Grey 2BLN Conc, no CI no.
Grey	Polar Brown 2GL Erio Anthracene Grey 2BLN Conc
Light Green	Polar Yellows, CI 642 Alizarine Sky Blue B, CI 1088
Light Blue	Alizarine Sky Blue B
Pink	Azo Rubinol 3 GP, Pr 412
Navy	Sulphon Cyanine 5R, CI 289
Cordovan	Sulphon Cyanine 5R Polar Maroon V Supra, no CI no. Polar Yellows
Maroon	Polar Maroon V Supra
Dark Green	Alizarine Cyanine Green, CI 1078
Blacks	(a) Nerol Black 2B, CI 304 (b) Sulphon Cyanine 5R Polar Yellows
Blacks	Erio Black J (this dye is suggested when no acetate is to be left white)

In checking all classes of dyestuffs, we also found that certain direct dyes were effective. In several instances they can be combined with the neutral-dyeing acid colors to produce well-working formulations, which show up very favorably from a cost standpoint.

As an example, in dyeing a black on nylon, acetate can be reserved to a greater degree than with the Nerol Black 2B (with the cost being reduced to less than one-half) by the following combination:

Chlorazol Dark Green, CI 583
Sulphon Cyanine 5R, CI 289
Polar Maroon V Supra

It has also become rather common practice to use vat-dyed cotton yarns for hose decoration. It then is necessary to select dyestuffs which leave cotton reasonably well undyed. Several among the above selected dyes are also adaptable for this work. The most outstanding of which are:

Polar Maroon V Supra
Sulphon Cyanine 5R
Erio Anthracene Grey 2BLN Conc
Polar Brown 2GL
Erio Black J

After cotton is dyed in the usual manner, it is cleared by a light, cold, hydrosulfite strip.

The application of Erional NW or Nylofix is usually all that is necessary on light to medium shades, as this aftertreatment has a decided clearing action on the cotton and improves the wash fastness of the stretch nylon.

METHODS OF DYEING ——— The dyeing methods are not so clearly defined as the color list, for they must be made adaptable to the individual dye formulations used. They would, however, fit into three general classifications, slight variations of each being occasionally necessary. Before proceeding with the details of these methods, let us discuss first the principles involved.

Because of the nature of the yarns themselves, it is considered advisable to keep a steady pH throughout the scouring and dyeing cycles. Since this is not completely practical, a compromise system is offered in which the last stage of the scouring is done on the acid side. The idea of the steady pH is a point often missed by dyers, as the information was not widely circularized during the early days of experimentation with these yarns. The control of the exhaustion of acid dyes normally used for dyeing stretchable nylon should be done by time and temperature control rather than by an abrupt lowering of the pH, as is the usual custom. Overlooking this point quite often leads to poor color results as well as to a reduced elasticity of the hose. When it is necessary to lower the pH, it is done gradually by including in the original bath an agent, such as ammonium sulfate or ammonium acetate. These salts of a weak base break down with increased temperature, the ammonia volatilizing, leaving the acid radical in the bath. In the case of heavy shades, it is permissible, after the major portion of the dye is exhausted, to add enough acid for total exhaustion, so that the full value of the dyestuffs may be realized. This also assures better repetition from batch to batch.

The first method for discussion is that used with *acetate (disperse) dyestuffs*, which are used almost exclusively for pastel shades in cases where no acetate is present in the hose. Restricted wash fastness makes them unsuitable for heavy shades. Scouring is done on the alkaline side, as was previously discussed, with subsequent dyeing at the same pH. Time and temperature are the controlling factors here as well.

The well-dispersed dyestuff is added to the scoured goods in a fresh bath at 110°F. The bath is then circulated for five minutes, the temperature is raised in 20 minutes to 185°F, and dyeing is continued at this temperature for 20 minutes.

This is usually all that is necessary to achieve level and consistent results. Shading additions are permissible at this temperature if they are added slowly, ten minutes being allowed for the feed.

The second method is used with dyes classified as completely *neutral-dyeing colors.* They are dyed usually in a bath containing no dyeing assistants after the scouring compounds have been removed by a warm rinse. An exception to this would be any formulation that would exhaust too rapidly, since in this case an organic leveling agent, such as Irgasol A, is helpful.

The dissolved dyestuffs are added at 100°F. The hose are dyed for 5 minutes before the temperature is raised to 190 to 200°F over a 20-minute period. Dyeing is carried on at that temperature for 15 minutes prior to the addition of salt and is continued thereafter for 20 minutes more at the high temperature.

An outstanding exception to this is the Erio Black J type, which exhausts without any assistance. In fact, forcing the dye by any means especially with acid will cause the shade to turn brown.

The third method is that used for dyeing colors which require a lower pH for exhaustion. It would follow, then, according to the principles previously discussed, that the scour would also be on the acid side. Here we strike a variation of opinions, for most processors consider it necessary to scour on the alkaline side to saponify the knitting and throwing oils. A compromise is achieved by scouring as usual, then adding acid to the last stages of the scouring operations. This achieves the retarding effect previously discussed as well as insures homogeneous goods and dyebath prior to addition of the dye. With this method no rinse is given for heavy shades after scouring, whereas, for pastel shades, a cold rinse is given to remove the residual acid.

The dissolved dyes are added to the cold bath, and after the goods have been run for 5 minutes, the temperature is raised to 200°F in 20 minutes. After 15 minutes at that temperature the addition of acid (when required) is made, and dyeing is continued for 15 minutes longer. When ammonium salts are used, they are entered into the bath prior to the addition of the dyestuffs. They are run in the same manner, of course, without the acid addition previously mentioned.

In some few cases, for fastness and for economy sake, selected chrome dyestuffs are used. The usual top-chrome procedure is followed.

AFTERTREATMENT FOR WASH FASTNESS——Since the neutral-dyeing milling types are used primarily to cover barré and other defects, it follows that in heavier shades some type of aftertreatment is desirable to improve wash fastness. The easiest method of fixing the dyestuffs is to use a prepared fixative, such as Erional NW or Nylofix. These products tend to increase the wash resistance substantially, but when maximum fastness is required, the following procedure is recommended:

Two percent tannic acid is added to the rainsed goods after dyeing. The temperature is raised slowly in 10 minutes to 160°F and is held there for 10 minutes. Two percent tartar emetic is then added slowly to the bath and is allowed to circulate for 15 minutes. A cold rinse is then given, followed by a soaping for 10 minutes at 140°F.

Combining acetic acid with the tannic acid is a common practice used primarily to hold the dye on the goods until fixation is accomplished. The faster the dyestuffs, the lower the quantity of acid necessary. One-half to 2% is usually sufficient.

SOFTENING ——— Softening is considered essential for the removal of internal friction to obtain the maximum elasticity. Also, a soft pliable hand is more appealing at the retail level. This poses no great problem, as most of the commercial products, both nonionic as well as cationic, do a creditable job. The addition of ½% calcium chloride to the softening bath increases materially the absorption of the softener. Not only does calcium chloride serve to precipitate the softener on the goods, but it aids also in moisture regain. Combined, they give a good hand as well as increased elasticity to the fabric.

PROCESSING ELASTIC NYLON FOR INGRAIN KNIT HOSIERY———In order that the coverage may be more complete, it seems advisable to mention the various methods undertaken to produce yarns for ingrain knit hosiery. Five methods have been undertaken with varying degrees of success.

1) In this method the yarn is dyed prior to being processed into stretchable yarns. This method has yielded some excellent results, especially when chrome dyes are used for the heavy shades. The patent for this method has been assigned to the Belmont Throwing Corporation.

2) Some effort has been expended in the hopes that yarn could be dyed in the highly twisted state prior to setting. No one to our knowledge has been able to produce yarn completely satisfactory by such a method. It is generally believed that the high twist has a "cording" effect, preventing adequate circulation of the dye liquor within the fibers. When the yarn is untwisted the shade change is so great as to be difficult to believe at times. A black may come back to a charcoal cast. A deep cordovan shows up as a medium brown.

3) Experimentation was undertaken by several people to dye yarn on tubes after it is processed in a package machine. Subjecting the yarn to heat in the elongated state diminished the stretch to such a degree that this method was found impractical.

4) A large number of mills have produced yarns for ingrain hosiery quite effectively by knitting the yarn into tubes, dyeing it, and then unraveling it onto cones. The relaxation of the yarn prior to its subjection to heat is apparently the secret to the success of this method. The chief drawback, however, is that during the dyeing operation additional setting is accomplished so as to yield a kinked effect, which shows up as a pebbled condition in the finished hose.

5) The latest method, which is considered by most processors to be the best and perhaps final answer, is the dyeing of the skeined yarn, referred to as "Muffs". The yarn is wound on skein machines with the traverse being such as to allow open spaces for the yarn to relax from side to side as well as lengthwise. As the relaxation takes place, the Muff contracts to a package small enough to be dyed in package machines. A spreader is used to open the center enough to insert the perforated tubes. The yarn may be laced on or covered with a knitted fabric to prevent tangling.

Hose knit from yarn dyed by this method have adequate stretch. The fabric is smooth and even as compared with the yarn dyed in the knitted tubes. The chief difficulty has been backwinding without tangling; however, many feel they now have this problem solved.

—♦ ♦—

NOTICE

To Authors and Section Officials

Under a new ruling of the Publications Committee, all papers presented before local sections of AATCC must be submitted direct to the managing editor of the AMERICAN DYESTUFF REPORTER, 44 East 23rd St, New York 10, N Y. Two copies of each manuscript should be submitted in accordance with the "Notice to Authors", which appears periodically in the *Proceedings*.

The Microdyeoscope

MICROSCOPICAL OBSERVATIONS ON DYEING*

HENRY E MILLSON

Organic Chemicals Division, American Cyanamid Company
Bound Brook, N J

The Microdyeoscope is a combination instrument, which permits microscopic observation and photographing of dyeing and other processes taking place on individual fibers in a very small cell, where bath conditions closely like those holding in large-scale work can be maintained. This report opens with a complete description of this unusual instrument and an explanation of how it works.

The author and coinventor has used the Microdyeoscope to study processes and phenomena of interest in textiles, including scouring grease wool, dyeing acid and milling dyes on wool; precipation of dyes on fibers; dyeing chrome dyes; action of leveling agents in wool dyeing; histology of wool subjected to different processes; bilateral effects in wool; bronzing in cotton dyeing; acetate dyeing; vat dyeing with circulation of pigment before reduction; and dyeing Dynel with milling dyes in the presence of a carrier.

INTRODUCTION

MANY investigations of the mechanism of dyeing have been described in the literature, and have presented a variety of experimental and theoretical considerations. Numerous practical observations have also been recorded of the appearance and behavior of the dyebath as dyeing proceeds, and much of this information has become common knowledge among dyers. In addition to contributing a vast amount of knowledge to the field, these studies have also revealed the desirability of an experimental study on a microscopic level of the changes taking place in both the fiber and the dyebath during the dyeing cycle.

The observed precipitation of dyes and dye complexes by the addition of chemicals, such as Glauber's salt, common salt, ammonium acetate or sulfate, acids and alkalies, suggests that macro inspection of the bath may fail to detect important changes which occur during the dyeing process.

It was recognized that the peculiar efficiency of certain cationic and nonionic substances in promoting level dyeing might be associated with phenomena that are visible in detail only under the microscope. Continuous microscopic observation of textile fibers and of the dyebath during the continuous and complete dyeing cycle offered opportunities for investigation not obtained by any other means.

The present author and L H Turl developed an instrument called the Microdyeoscope, which permits both visual observation and recording, by photographic means on a microscopic scale, of dyeing phenomena that occur under approximately the conditions encountered in the usual commercial dyeing processes. This instrument and a number of dyeing studies carried out with its aid are described in this paper.

Several authors have recorded observations of dyeing carried out under the microscope, usually with the aid of a heated microscope slide or stage. Such experiments have been of value, but have not permitted measurement or control of such factors as temperature, dye and salt concentration, bath ratio, and pH of the dyebath; nor has it been possible to carry out conveniently a sequence of dyeing operations, such as are required in vat dyeing. The removal of fibers from the dyebath for microscopic examination has necessarily interrupted the dyeing cycle and precluded further observations of the same fiber. Differences in behavior between fibers particularly of the natural group, ie, wool or cotton, together with the changes attendant upon drying and mounting for microscopic observation, have also reduced the potential value of studies carried out by previous techniques. The Microdyeoscope, in addition to providing means for the control of important factors in the dyeing process, permits the continuous microscopic examination of the same fiber or fibers through all stages of the operation, including wet processes either preceding or following the dyeing cycle. The progress of dyeing can be followed, and the changes occurring at any given point on a fiber may be studied while the sorption of dye proceeds. The progress of other wet processes, such as scouring, bleaching, stripping, and chlorination, can also be observed continuously under closely controlled conditions.

THE MICRODYEOSCOPE[1]

DESCRIPTION —— The essential merit of the Microdyeoscope is that it permits the continuous observation of microscopic phenomena associated with the dyeing and treating of textile fibers under controlled conditions simulating those used in practice. This is accomplished by means of the circulation of a normal dyebath through a cell designed to permit microscopic observation of fibers mounted within it and forming part of the dyebath-fiber system. Circulation is achieved by the use of a nitrogen gas lift incorporated into the apparatus. Temperature control is maintained by electrical heaters designed to correct for heat losses in the circulating system and to insure that the cell in which observations are made is as nearly as possible at the same temperature as the main dye chamber.

A suitable system of glass connecting tubes, valves, and an auxiliary chamber permits control of the flow through the cell and also provides for rinsing or other treatments within the cell during or at the conclusion of the dyeing cycle. Figure 1 shows the schematic arrangement of these features. A standard microscope with an especially modified mechanical stage is employed to carry the cell and to permit continuous observation of the fibers and process under study. A ribbon-filament type of substage illuminator was chosen for visual or photographic observation and for projection of the field onto a screen. These features are shown in the general view of the apparatus (Figure 2).

The dyeing chamber, which serves to establish the dyebath conditions and to permit macro experimental control of the dyeing, is a glass cylinder approximately 50 mm in diameter with a volume capacity of 330 ml. Its upper end forms the female section of a 55/50 standard-taper ground joint, into which is fitted

* Presented before the following sections: New York (Jan 11, 1952); Southeastern (Feb 23, 1952); Mid-West (Oct 4, 1952); Philadelphia (Oct 23, 1953); and Rhode Island (Jan 28, 1954).

[1] The Microdyeoscope and some of these studies were described previously in *Textile Research J (15)*.

a standard water-jacketed condenser. The holder by which the yarn, fabric, or slubbing is suspended within the dyeing chamber is carried by the lower end of a rod projecting axially upward through the condenser. This holder consists simply of a suitable length of glass rod or tubing to which are attached fittings, or cross pieces, designed to carry the sample being dyed in the chamber. The weight of this sample is chosen to provide the desired dyebath ratio. Near the upper end of the dyeing chamber and above the normal level of the dyebath, a ground-glass stoppered opening is provided for making additions to the dyebath. This opening is normally closed by the insertion of a thermometer.

The lower end of the dyeing chamber is hemispherical and leads into two outlets of glass tubing, each 10 mm in diameter. One of these, centrally placed, serves as a drain with stopcock, and also leads via a by-pass tube (with a large-bore stopcock) to the base of the gas-lift tube. The by-pass tube permits continuous circulation of the dyebath, whether or not flow takes place through the cell. The lower end of the gas-lift tube is fitted with a three-way stopcock serving either as a return from the observation cell or as a drain for the cell and/or the dye chamber, as required. The gas lift is provided by the introduction of nitrogen under low constant pressure through a jet inserted into the gas-lift tube just above the by-pass level. In the gas lift, alternate bubbles of nitrogen and dyebath liquor rise upwards, the gas escaping through the condenser while the dye liquor returns to the dye chamber.

The second outlet at the base of the dye chamber leads through a two-way stopcock directly to the microscope observation cell. Through this stopcock an auxiliary chamber may also be connected to the cell, at the same time cutting off the flow of dye liquor from the main dyebath chamber. This operation provides for rinsing and repeated cyclic wet treatments in the cell. Short flexible tubes connect the cell to both the two-way stopcock and the three-way stopcock at the base of the gas-lift tube. When these stopcocks are correctly set, dye liquor flows continuously from the dye chamber through both by-pass valve and the observation cell to the gas lift, and thence returns to the dye chamber. The rate of the flow through the cell is controlled by the stopcock setting, or by an auxiliary clamp on the flexible connecting tubes, and the by-pass stopcock setting. Since the interior volume of the cell is only 0.3 ml, the flow of liquid through it at maximum rate corresponds to about seventeen complete changes per second. The flow is maintained normally at about one-third of the maximum rate.

The cell is constructed as shown in Figure 3. The body of the cell is turned from a bar of type-316 stainless steel. It is cylindrical in form, and is fitted with windows on both flat faces. The rear window is a small disc of quartz or glass approximately 1 mm thick secured against a pure-gum-rubber gasket by a bronze external retaining ring, which screws into the body of the cell. The front, or observation, window is a single microscope-slide cover glass 25 mm in diameter, and which should not be greater than 0.20 mm in thickness. This is held in place by a similar gasket-and-bronze-ring assembly designed and fitted to permit the close approach of a microscope objective over the widest possible area of the window. The thickness of the cell, that is, the space between the inner faces of the two windows, is approximately 4 mm. Ports around the periphery of the cell body permit flow of the bath into and from the cell cavity through stainless-steel fittings.

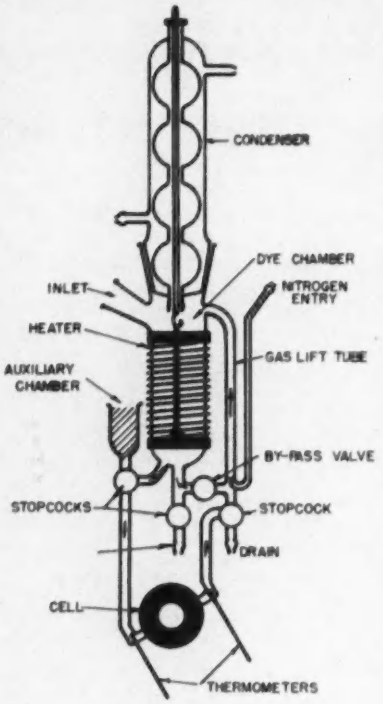


Figure 1
Schematic diagram of the Microdycoscope circulating system

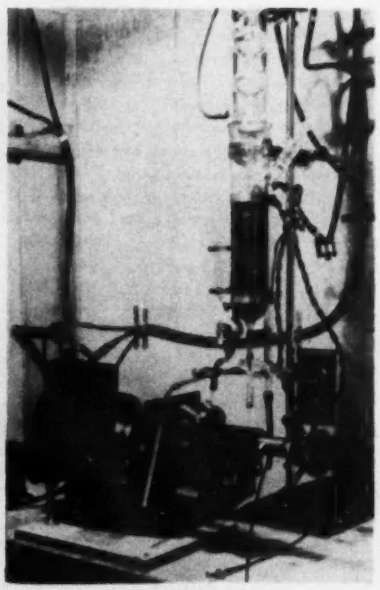


Figure 2
General view of the Microdycoscope showing circulating system, light, cell, microscope and Micro Ibso attachment.

The cell body is mounted securely on a standard microscope mechanical stage, which is used in the normal manner to bring any desired point of the interior of the cell to the optical axis of the microscope (Figures 4 and 5). The flexible connections between the cell-port fittings and the glass dye-chamber apparatus permit adequate motion for this purpose. Obviously, the entire apparatus might be moved relative to the microscope, but the simple mechanical-stage treatment offers the great advantage of simplicity and rigidity at low expense, and flexible connecting tubes were readily available in a variety of materials suitable for the purpose. The optical axis of the microscope is secured in a horizontal position, providing a simple arrangement for the substage illuminator and the camera or projection screen, in addition to permitting connections of minimum length between cell and dye chamber.

The ribbon-filament type of illuminator has been found most satisfactory in obtaining the intensity and uniformity of field necessary for color photography, which is accomplished with standard Leitz equipment on 35-mm Kodachrome, Type A film. Exposure times are estimated by means of direct readings of projected field intensity taken with a Weston Master II Exposure Meter, and range from 0.01 second to 1 second, depending chiefly upon magnification power and depth of color of the dyebath. The Weston Meter can be replaced with a galvanometer, which is more elaborate and accurate for determining light intensities and duration of exposure.

Temperature control throughout the system is achieved by three independent nichrome-wire heaters. The main heater is wound in an open helix around the dyeing chamber, and is supplied with power from a variable transformer, which is manually controlled either to provide the desired rate of rise of temperature or to maintain a given constant dyebath

temperature. Two auxiliary heaters of low wattage were originally employed to compensate for heat losses along the connecting tube leading from the dye chamber to the cell, and from the cell itself by radiation. These auxiliary heaters served to maintain the temperature of dye liquor entering and leaving the cell at the same temperature as the main body of the dyebath in the dye chamber, but were later removed owing to difficulties of control at the boil. Thermometers are located in the dye chamber and also in special glass fittings at the entry and exit ports of the cell, permitting continuous observation of dyebath temperature at these points. The use of automatic regulating equipment in temperature control

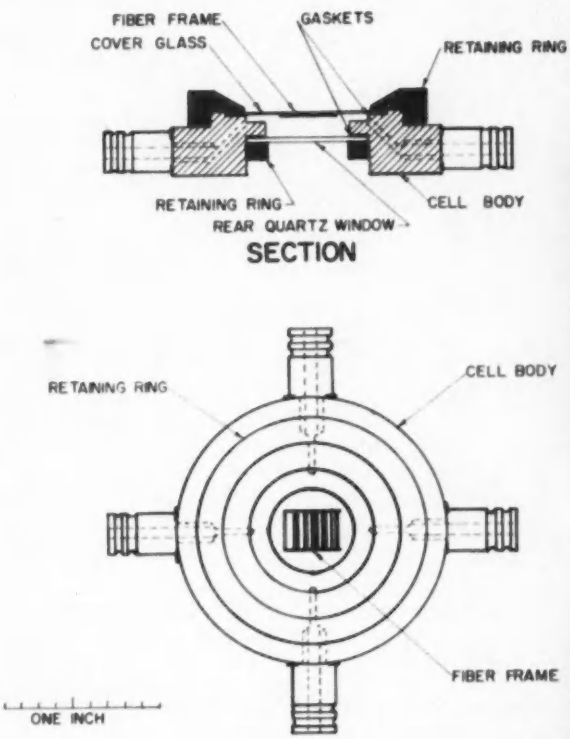


Figure 3

Diagram of the Microdyeoscope cell.

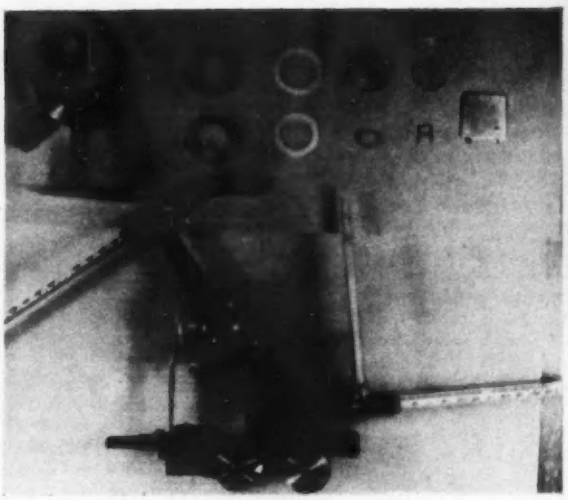


Figure 4

Cells, parts and mechanical stage assembly. The upper cell has two ports, the lower cell has four.

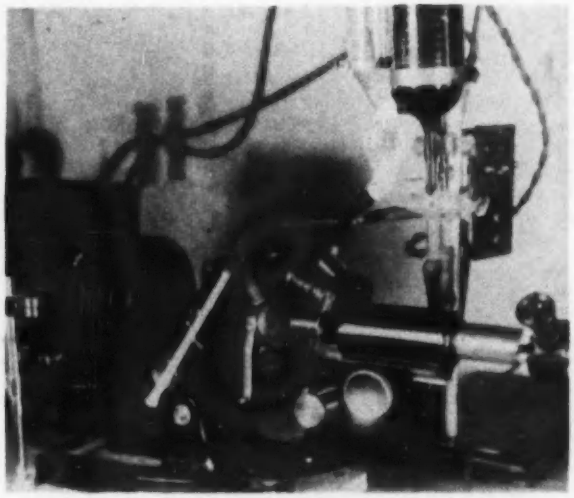


Figure 5

Close-up view of observation cell in position in the Microdyeoscope.

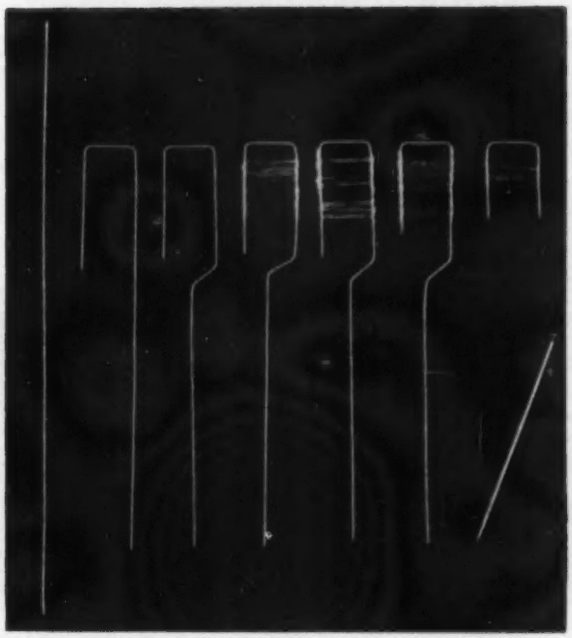


Figure 6

Preparation of frames and fibers for observation in cell. From left to right: length of wire of which frame is made; frame formed; frame handle made coaxial with frame for uniform winding; continuous filament of viscose rayon wound onto frame; variety of fibers wound on same frame (from top to bottom, viscose rayon, wool, nylon, dynel, a Sea Island cotton fiber, Dacron, Orlon and Acrilan); five wool fibers, 60's quality, each about 5 in long; three wool fibers tied together before winding and wound as a single-fiber (this frame has been cut to the actual size required by the cell following the fiber-winding operation); a 1-inch common straight pin is shown for comparison.

and equalization would be a desirable refinement of the present apparatus. Automatic continuous high-temperature electrodes for determination of pH during dyeing or other wet treatments would also be a desirable feature of future apparatus.

OPERATIONAL PROCEDURE——Fibers selected for observation in the cell are mounted by winding on U-shaped frames formed of Nichrome Wire No. 24, size 0.020 millimeters (Figure 6). Each frame may carry up to 10 fibers, as desired, so that several fibers of the same type or different types may be kept under observation in a single experiment.

The mounting of each fiber is accomplished by tying one end to the frame and attaching a small tensioning weight to the other end (see Figure 47). After the fiber is wound onto the frame in a series of closely spaced turns, the free end of the fiber is secured in place by a light coat of an adhesive that is inert to the conditions of the experiment. The use of an adhesive is necessary because of the difficulty of tying a second knot to secure the fiber to the frame with maintenance of the proper tension on it. Both collodion and cellulose acetate dissolved in acetone have been found very useful as adhesives. The tensioning weight is then removed and the next fiber is attached in the same manner. With skill, it is possible to wind fibers so that several segments of the same fiber or segments of several different fibers may be viewed simultaneously in the field. In addition, fiber configurations and treatments of special interest can be devised, such as knotted fibers, twisted fibers, incisions or other mechanical damage to fibers, and partial fiber exposure to light or chemical attack. Specific parts of the fiber may thus be used as a control on a variety of treatments applied to the remainder of the same fiber. The necessary experimental techniques are well within the abilities of persons familiar with single-fiber experimentation.

To place the frame containing the fibers in the cell, the rear window is removed and the fiber frame is laid upon the inner face of the front window. A tiny flat helical stainless-steel wire spring is then laid on the frame, and the rear cell window and retainer ring are replaced, providing a slight pressure against the frame through the spring. The frame is thereby held against the front window, and the fibers are located immediately behind this window, as seen from the microscope. The fibers in this position are easily within range of the conventional microscope objectives. In the use of high-power objectives, care must be taken to avoid rupturing the front window of the cell by incautious approach in focusing. Frames are normally so placed in the cell that the fibers wound on the frame lie parallel to one of the directions of the mechanical stage motion. Fibers are then easily examined along their entire length by manipulation of the stage controls.

Figure 7
Grease fiber taken directly from raw fleece.

Figure 8
Same fiber 30 seconds after addition of cationic surface-active agent at 90°F.

Figure 9
Same fiber 15 minutes after addition of agent at 130°F.

APPLICATION OF THE MICRODYEOSCOPE

SCOURING GREASE WOOL——Scouring is an important operation in the preparation of wool for dyeing, and this is especially true when fleece wool is processed. The complete removal of extraneous yolk, suint, oils and dirt from the fibers exposes the fiber surface uniformly to dyeing and treating baths. Ideally, the scouring bath should have a high degree of detergency without attacking or damaging the scale structure of the fiber. There is a trend toward the use of neutral or acid scour baths, which are less damaging to the wool than are strongly alkaline baths. Certain types of cationic surface-active compounds are excellent for scouring fleece wool, and one such agent is Aerosol*SE wetting agent *(21)*. Figure 7 shows a fleece wool fiber enveloped with its natural coating of wool grease, mounted in the Microdyeoscope in water at room temperature.

Sufficient Aerosol SE wetting agent was added to bring the concentration to a 0.5% solution with a pH of 7. Figure 8 shows the same fleece fiber 30 seconds after the addition of a solution of Aerosol*SE wetting agent. The scale structure is partly revealed by the removal of the wool grease. Figure 9 shows the same fiber after scouring for 15 minutes at 130°F. Note the sharp scale structure and complete removal of surface materials. Dyeing and staining experiments for the detection of damage showed no signs of surface or scale damage.

ACID AND MILLING WOOL DYES——Microscopical studies have demonstrated that the cuticle of the wool fiber produces a difference in the behavior of acid and neutral-dyeing wool dyes, including representatives of the sulfuric acid leveling types, the neutral-dyeing or milling types and dyes intermediate in properties. These investigations have also revealed differences in the dyebath, which are important.

In each experiment, several fibers taken from a clean Australian Merino fleece were wound onto the same wire frame and dyed together in the cell. One fiber

* Registered trademark

Figure 10

Deformation of wool fiber due to atrophy showing preferential absorption of the cobalt complex of Eriochrome Verdun B. Note raised scales on upper part of atrophied area.

was given a mild acid chlorination prior to mounting and was used to provide a comparison with untreated fibers. In general, different fibers, even though taken from the same staple, do not dye precisely alike. Certain local areas of each fiber resist the sorption of dye more than other areas, while areas of atrophy, degradation or "damage" to the fiber surface, readily admit the dye (Figure 10). The degradation of the cuticle by chlorination is very similar to degradation of the cuticle by natural weathering or by other chemical or physical agencies, as shown by the rate of dye absorption. The removal of the protective epicuticle permits more rapid sorption of dye at lower temperatures. The temperature at which these differences of sorption are noted depend mainly upon the choice of dye.

Wool fibers dyed with members of the class represented by Calcocid Orange Y (CI 151), a sulfuric acid level-dyeing type, exhibited a minimum of local differences in sorption, and such dyes have commonly been considered incapable of producing fiberwise variations in depth of shade. It is significant, however, that even with these types, local penetrations can be observed in the tips or other damaged areas of the fiber at temperatures in the neighborhood of 120°F. At higher temperatures, the fibers are uniformly colored, even though much surface damage and degradation are present. For this reason, chlorinated and untreated wools appear approximately equivalent in depth of shade throughout most of the dyeing cycle and at its completion.

A second type of dye is represented by Calcocid Alizarine Blue SAPG (CI 1054), an intermediate dyeing type. Local variations in coloration of the fiber are noted at temperatures as low as 140°F, and these become extremely pronounced in the range of 170-180°F. Different fibers may exhibit marked variations in coloration at these temperatures because of differences in their surface condition.

Under normal dyeing conditions, the dyebath appears to be exhausted at 190°F. At the boil, however, the color variations in the fibers become less prominent, and each fiber is uniformly colored within 30 minutes. This behavior, together with the observed diffusion of Blue SAPG within the fiber in regions surrounding incisions through the cuticle, suggests that diffusion through the cortex is an important factor in the leveling of these dyes. Observations made thus far with the Microdyescope have not permitted an estimate of the relative importance of diffusion within the fiber and the part the bath itself plays as the medium for the redistribution of the dye.

Milling dyes, such as Calcocid Milling Red BC (CI 430), constitute a third class, characterized by extreme unlevelness or selectivity, and exhibit extreme local variations with no observed capacity for leveling at any temperature lower than 200°F. With this class of dyes, normal wool fibers exhibit only slight and irregular coloration until 185°F is reached, although chlorinated fibers absorb these dyes at much lower temperatures and with comparative uniformity. At the boil, these dyes level only partially, and variations remain between different portions of the same fiber and between different fibers.

The absence of leveling ability of milling dyes together with the absence of definite coloration in the fibers at temperatures lower than 200°F can be explained by the extremely high resistance of the cuticle to the penetration of this type of dye. When the cuticle was incised by the method shown in figure 48, Microdyeoscopic studies showed that milling dyes penetrated the fiber quite readily at the point of incision. This was followed by diffusion of the dye from the incision into the cortex in both directions along the fiber. Otherwise, the fiber remained undyed or was only lightly dyed (Figure 11).

Figure 11

Incised wool fiber showing penetration and diffusion of a milling dye after boiling 30 minutes. Note diffusion of dye away from point of penetration.

Acid dyes not only exhibit the ability to penetrate the cuticle much more readily at temperatures in the range 145 to 160°F, but the available evidence on rates of diffusion within the cortex also indicates that acid dyes diffuse much more readily than milling dyes. These two differences account for the observed superior leveling properties of the acid types; they also explain the uniform distribution of color obtained when the cuticle has been uniformly degraded by processes, such as chlorination.

PRECIPITATION OF COLOR IN THE DYEBATH———Precipitation may occur in normal dyeing operations with consequent spoilage of the goods, and the dyer may find himself unable to correct this condition by expedients, such as adjustment of the dyebath, additions of dye solvents and/or alkalies, or by rinsing and washing. Precipitation may also occur in the course of normal dyeing cycles

without detriment to the lot or realization of its occurrence by the dyer. The dyer may note a slight turbidity or opalescence, or a lack of transparency of the dyebath, without recognizing the presence of a precipitate. In practice, bronzy films or scum floating on the surface of a dyebath are an indication of the presence of a precipitated dye or derivative, which may cause trouble if steps are not taken to redissolve it. With the Microdyeoscope, the causes of this condition become immediately apparent. With this apparatus, modifications of troublesome dyeing procedures can be studied, and corrections evolved. These improvements can then be incorporated into the practical methods.

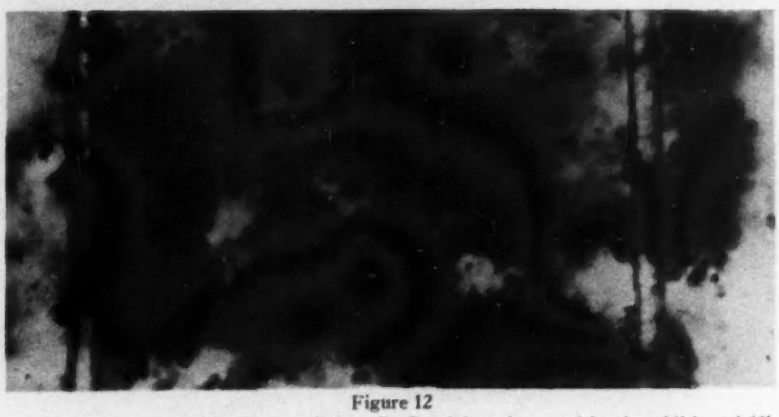


Figure 12

Wool fiber surrounded by Chrome Brown B. Precipitate is caused by the addition of 6% ammonium sulfate to a 2% dyeing at 80°F.

PRECIPITATION IN TOP-CHROME AND METACHROME DYEING —— Practical difficulties are well known in the application of many chrome dyes by the conventional top-chrome and metachrome methods. While the reasons underlying these difficulties have not been clearly understood, certain modifications of the methods have been devised to overcome them. It was thought that these difficulties might be associated with the acid sensitivity of the dyes and that precipitation effects might be responsible, at least in part, for their behavior. Studies with the Microdyeoscope have confirmed this belief.

Chrome Brown B, CI 101, and Calcochrome Orange R, CI 40, can be precipitated readily by the addition of acetic acid to the top-chrome dyebath. Both dyes produced crystalline precipitates which were observed to accumulate on the fibers at room temperature and which redissolved as the temperature was raised. The presence of Glauber's salt did not influence this behavior appreciably. The Orange R precipitate was entirely redissolved at 120°F, and no further complications were observed during dyeing. The Brown B precipitate, however, redissolved very slowly at temperatures of 170°F or higher and was incompletely redissolved even after 30 minutes at the boil. In both cases, little coloration of the fibers was observed until the precipitated dye was partially redissolved.

It is known from practical experience that Chrome Brown B will yield dyeings of poor fastness to crocking, washing, and fulling if the initial pH of the dyebath is in the range 3-4. Under sufficiently acid conditions, the original copious brown precipitate may remain on the fiber throughout the dyeing and chroming operations, giving rise to poor wet-fastness properties. The precipitation can be prevented by starting the dyeing alkaline by the use of both ammonia and ammonium sulfate, followed by careful exhaustion of the bath with dilute acetic acid after 30 minutes at the boil.

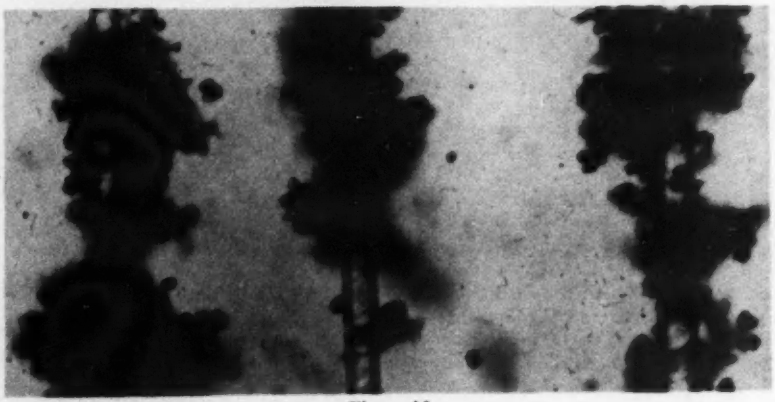


Figure 13

Same wool fiber as in Figure 12 with Chrome Brown B precipitate at 185°F, diminished by partial re-solution.

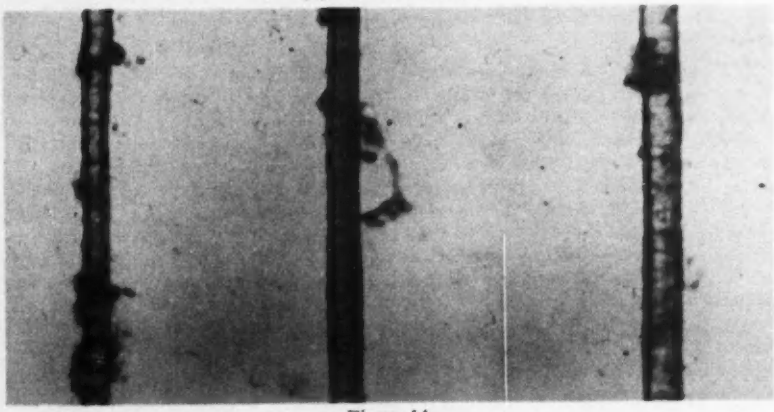


Figure 14

Same wool fiber after being dyed with Chrome Brown B one hour at the boil. The re-solution of the precipitate is virtually complete, and the fiber is uniformly dyed.

Chrome Brown B also affords an interesting example of the influence of special agents and/or procedures in metachrome dyeing. Following a normal metachrome dyeing procedure, the addition of 6% ammonium sulfate to a dyebath containing 2% Brown B produced a copious brown precipitate, which accumulated on the fibers in the dyebath as a combined particle and gel deposit. The addition of 1¼% sodium bichromate caused further precipitation and cleared the dyebath entirely of dissolved dye at 80°F (Figure 12). As the dyebath temperature was raised to the boil, the precipitate redissolved partially, with coloration appear-

ing both in the dyebath and in the fibers (Figure 13). One hour's boiling was necessary, however, to remove most of the precipitate from the fiber and to achieve satisfactory exhaustion of the bath (Figure 14). In comparison with this procedure, a modified process, the Calcomet Method *(16)*, required the addition, in successive order, of the dye, 1% ammonia, 6% magnesium sulfate, 0.8% sodium bichromate, 3% Calcomet Salt Powder (a colloidized cationic agent), and 4% ammonium sulfate. No precipitate was observed in this system. The dyebath was raised to the boil and boiled for an hour to secure uniform and complete exhaustion.

The individuality of dyes was emphasized by the contrasting behavior of Eriochrome Verdone S, CI 292, under the conditions described above for the conventional metachrome method of dyeing Brown B. Verdone S, applied by this procedure, remained unprecipitated, and proceeded through an orderly sequence of absorption and chromation with attendant color change at the boil. This behavior has been previously reported *(16)* for a number of chrome dyes which are absorbed as acid dyes and subsequently chromed as the temperature approaches or is maintained at the boil. When Verdone S was applied by the Calcomet method, the addition of magnesium sulfate resulted in the formation of a red gelatinous precipitate, with almost complete precipitation of the dye. The addition of the remaining reagents in the method produced little change in this precipitate, which redissolved slowly only at temperatures above 185°F, with concurrent development of the chromed green shade in the fibers. The precipitate remained reddish in color, and persisted at the boil for some time. After one hour's boiling, the dyebath exhaustion was complete, and the fully developed shade was obtained in the fibers.

These and other studies of modifications of the top-chrome and metachrome processes have suggested explanations for several cases of anomalous behavior. The extreme individuality of dyes, however, offers a serious obstacle to the theoretical consideration of the dyeing processes beyond the concept of the initial absorption of chrome dyes essentially as acid types, followed by chromation within the fiber at elevated temperatures. As has been pointed out previously *(13)*, chlorination and other forms of chemical attack on the cuticle of the wool fiber permit more rapid dye absorption at temperatures below that at which unfavorable reactions occur in the metachrome dyebath system in the presence of unabsorbed dye. Treated fibers can therefore be dyed by the metachrome method with dyes that otherwise are not successfully applied in this manner.

THE CHROMATION OF WOOL DYES ——— In addition to the metachrome studies described above, the progress of chromation of dye within the wool fiber has been observed with the Microdyeoscope. Dyes exhibiting an extreme change of shade during chromation, such as Calcochrome Fast Red ECB, CI 652, or Calcochrome Brilliant Blue BBG, CI 720, offer excellent visual opportunities for this purpose.

To study chromation, wool fibers were subjected to crushing, incisions, knotting, and other treatments known to perforate or break down the resistance of the cuticle to penetration by dyes. Two percent Calcochrome Fast Red ECB, CI 652, was applied with 10% anhydrous sodium sulfate and 3% of acetic acid, 28%. The addition of the acid resulted in a slightly turbid dyebath, with the appearance of minute particles in the Microdyeoscope cell, indicating the partial precipitation of dye at room temperature. Raising the temperature to 120°F effected complete resolution of the precipitate, and the dyeing proceeded as in a normal acid dyeing. Red ECB was absorbed selectively up to 190°F, exhibiting local variations in intensity along the length of each fiber, particularly at points of degradation or damage, at which very early penetration of the dye was observed. At the boil, these local variations diminished rapidly, and a completely uniform golden shade was obtained along each fiber after 15 minutes. After 40 minutes of boiling, the dyebath was exhausted and 1% sodium bichromate was added. At the time of this addition, the field containing the damaged fibers was under observation. Within 3 minutes after the addition of the bichromate, local chromation was observed in the damaged portions of the fibers. These local areas quickly developed the bluish-red shade of the chrome dye, while the undamaged fiber areas remained the golden yellow shade of the unchromed Red ECB. During succeeding intervals of time, the diffusion of chrome was observed through regions adjacent to damaged areas and, finally, throughout the fibers as a whole. These observations indicate that the penetration of the chromium compounds used for chromation is dependent upon the cuticle in a manner similar to that observed for dyes themselves.

LEVELING AGENTS IN WOOL DYEING ——— Previous investigations *(13)* have shown that, in the application of metalized dyes to wool, tippy dyeing and unlevelness can be controlled or eliminated by the use of certain surface-active agents. In general, both nonionic and cationic agents are known which are useful as additions to the dyebath. In other cases, mixtures of both types may provide leveling and dyebath behavior superior to that of either type alone *(19)*. One of the most common dangers associated with such applications is the formation of a scum which cannot be removed readily from the goods or the dyeing machinery. The Microdyeoscope has proven to be a valuable tool in the study of these agents since both the dyebath and the fiber surface can be observed closely and constantly during the entire and uninterrupted dyeing cycle.

At temperatures below 200°F, metallized dyes do not readily penetrate the intact cuticle of the wool fiber, but are readily absorbed in areas and localities of cuticle damage. Diffusion within the fiber is slow, and, in a weakly acid dyebath, dyeings of extreme nonuniformity are obtained. The presence of sulfuric acid or the use of leveling agents (together with a reduced quantity of acid) are means of securing a more uniform distribution of dye. The mechanism of these two alternative approaches to the practical problem is not fully understood, but may be associated with either the degradation of the cuticle of the wool fiber by sulfuric acid or the "dye reservoir" effect of the leveling agent, which retards dye absorption until high temperatures have been reached. The reservoir effect is particularly important since fiber selectivity is greatest in the early stages of dyeing because of the penetration of damaged areas at low dyeing temperatures *(14)*.

The effect of boiling solutions of sulfuric acid and the loss of surface characteristics of the wool fiber have been observed and photographed repeatedly in the Microdyeoscope. The effect appears to be governed by acid concentration, time, and the particular dye used. In a few cases, the normal well-defined scale structure is virtually obliterated, but, in general, only moderate surface damage is observed. A similar effect has been noted in prolonged boiling with bichromate, while with weakly acid dyeings this surface degradation is slight. High sulfuric acid concentrations, by attack on the cuticle of the fiber, afford a means of promoting level dyeing, but the application depends also upon the rate and extent of exhaustion of dye from a highly acid dyebath. In the case of metalized dyes, this rate is satisfactory with the acid concentrations necessary to achieve the leveling effect.

Microdyeoscopic studies have shown that many cationic agents react with metalized dyes in the presence of sulfuric acid to form highly colored precipitates, which may exhibit solid, viscous, or highly fluid properties, depending upon temperature. A large proportion of the dye present is rendered inactive temporarily by formation of complexes which yield dye slowly

to the dyebath on prolonged boiling. A large number of experimental dyeings have been performed demonstrating this behavior. As an example, a dyebath was prepared containing 2% Calcofast Wool Bordeaux RB Conc and 0.6% of a cationic agent (condensation product of octadecyl guanidine bicarbonate and ethylene oxide) *(20)*. The addition of 5% sulfuric acid to the transparent, colored dyebath produced an immediate precipitate of fine, insoluble, gelatinous particles, which began to adhere to the fibers. The precipitated material was very deep red and built up rapidly on the fiber in a coarse fernlike structure (Figure 15). As the temperature was raised to 110°F, fusion began to occur in this structure, which, by 140°F, had changed to a sequence of large, irregular, deep-red, viscous, liquid globules attached to the fibers in the manner of drops of water on a thread (Figure 16). The fibers at this temperature were tinted but slightly. At the boil the dyebath was colorless, but the precipitate had changed very little. During the boiling period, the color in the globule was reduced gradually, with a constantly increasing, but uniform, coloration of the fibers. After approximately 90 minutes' boiling, the fibers were deep red, while the viscous precipitate had been largely decolorized and reduced in volume to a fraction of the original. It was noted that, although a number of large colored globules remained fixed on the fibers during the dyeing operation, the coloration of the fiber adjacent to the boundaries of these globules was identical in depth of shade with the remainder of the fiber. This was also true when metalized Blue GR was used (Figures 17 and 18). Previous work *(13)* has shown that, when dyes penetrate the cuticle at any point, diffusion with the fiber results in an area of deeper coloration surrounding the point of entry. The transfer of dye therefore does not occur directly between the fiber and the dye-agent complex, but takes place through the aqueous dyebath phase.

The same behavior has been noted with many dyes, although wide differences have been observed among cationic and blended cationic-nonionic agents. The uniformity and depth of shade obtained on skeins of wool yarn dyed in the presence of such agents is much superior to those dyed without them because of their property of improving the fiberwise uniformity of the dyed wool. This is believed to be due to the dye-withholding action of the dye-agent complex, which acts as a dye reservoir during the early and critical stages of dyeing when unequal absorption of dye is most likely to occur. The gradual release of dye from the complex during boiling is accompanied by the uniform absorption of dye by the fiber, since at high temperatures the cuticle is pen-

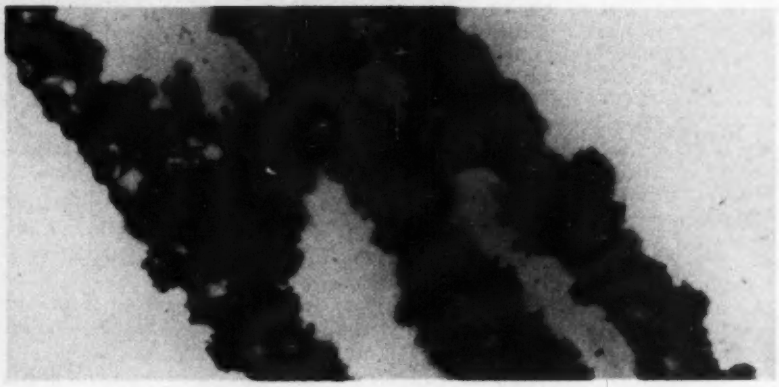


Figure 15

Wool fibers heavily coated with fernlike deposit of dye-cationic agent complex (2% Calcofast Wool Bordeaux RB Conc, 0.6% cationic agent, 5% sulfuric acid) at 85°F.

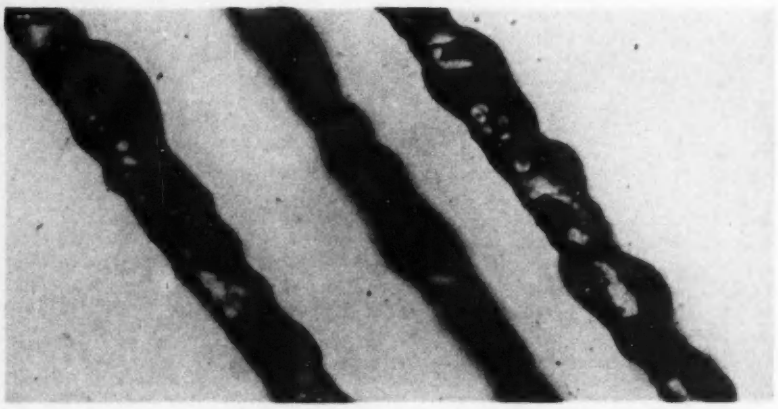


Figure 16

Same dyeing and fibers as in Figure 15 showing fusion of precipitated complex at 140°F. Note fiber is uncolored

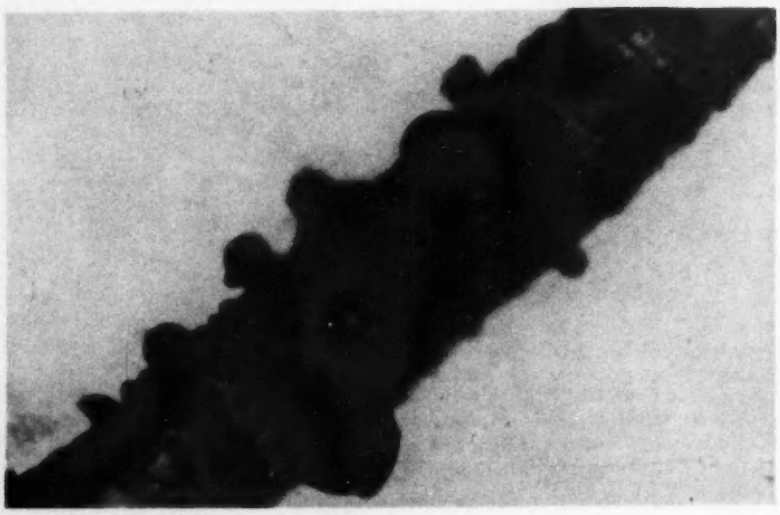


Figure 18

Precipitated dye-agent complex still adhering to wool fiber surface after 1 hour's boiling. Note that the region surrounding the contact area of the globule is similar in shade to the rest of the fiber. This shows that the dye is not absorbed from the globule at the point of contact.

FIGURE 17

Precipitated dye-agent complex attached to wool fiber surface. Note that region of fiber surrounding globule is the same shade as the rest of the fiber after boiling 30 minutes.

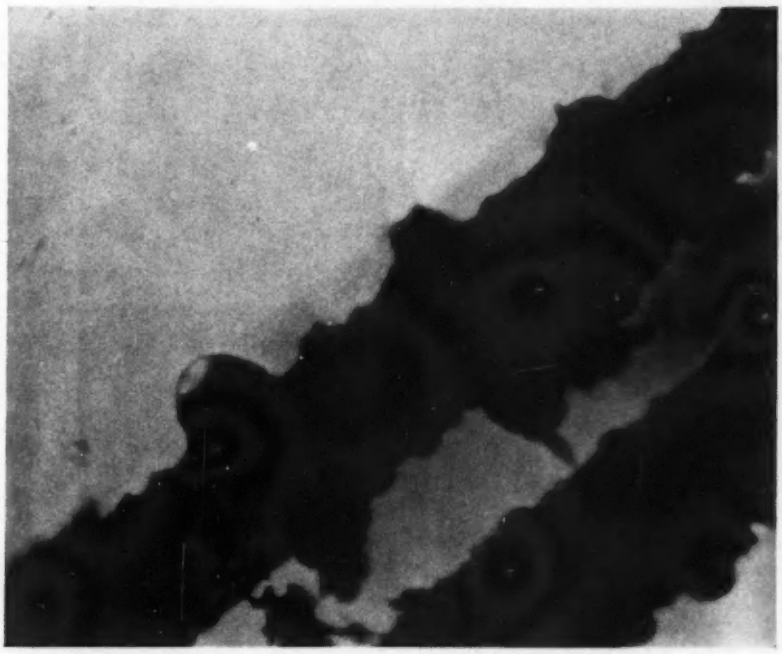


FIGURE 22

Two-phase effect observed during the boiling period within globule of fused precipitated dye-agent complex.

etrated more rapidly. This process is shown in Figures 19, 20 and 21, in which the reduction of the size and intensity of coloration of the complex masses is noted. The development of an unexplained colorless phase within the complex is frequently observed during the reduction process, as can be seen in Figures 22 and 23. There is evidence that this phase is soluble in the aqueous dyebath and may represent the combined agent-acid residue remaining after the release of dye to the dyebath. Much remains to be learned of the nature of the precipitated complex and of its ultimate disposition in the dyeing. The very strong adhesion between the cationic-type complex and the fiber has been demonstrated by the ability of these precipitates to resist extremely high rates of liquor flow through the cell without being removed from the fiber surface. The somewhat improved hand of wool dyed in the presence of surface-active agents suggests their retention either within the fiber or on its surface.

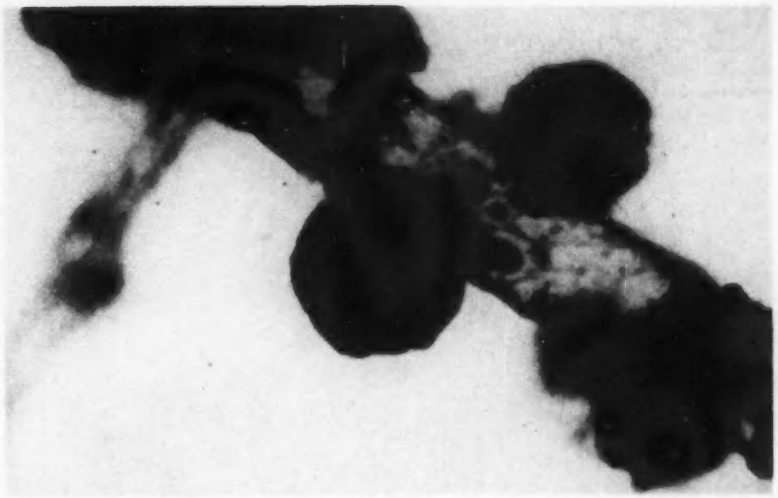


Figure 19
Precipitated and fused complex of metalized Blue GR blended cationic-nonionic surface-active agents (3% metalized Blue GR, 4% Calcofast Salt MD 80, 10% sulfuric acid) adhering to wool fiber after 15 minutes at the boil.

HISTOLOGICAL STUDIES ON THE WOOL FIBER———The Microdyeoscope has been particularly useful in the continuous observation of individual fibers throughout a series of wet treatments which were often terminated only by the complete disintegration of the fiber. The behavior of chlorinated wool under aqueous alkaline conditions is well known and is of interest both to the scientist and to the textile industry, particularly in view of the possible demand by the armed services for shrinkproofed vat-dyed wool.

Many investigators have studied the formation of Allwoerden sacs during the acid chlorination of wool *(2, 4, 5, 8, 9, 13, 18)*. It is generally agreed that these sacs are formed by osmotic pressure within the epicuticle. When a wool fiber is treated with a dilute-acid hypochlorite solution,[1] the phenomenon shown in Figure 24 is observed within 30 seconds. If the chlorinating solution is rinsed away at this point, the Allwoerden sacs remain inflated and stable. Treatment with solutions of acids, such as benzoic, sulfuric, and acetic, or with a solution of Calcozine Red BX[2] causes the sacs to contract rapidly through the stage shown in Figure 25 to that shown in Figure 26. Rinsing with water restores the sacs to their fully inflated condition. This cycle may be repeated many times.

If at any stage in this cyclic treatment a dilute solution (0.01%, pH 11.15) of sodium hydroxide is brought into contact with the fiber, the individuality of the sacs is destroyed, with the formation of

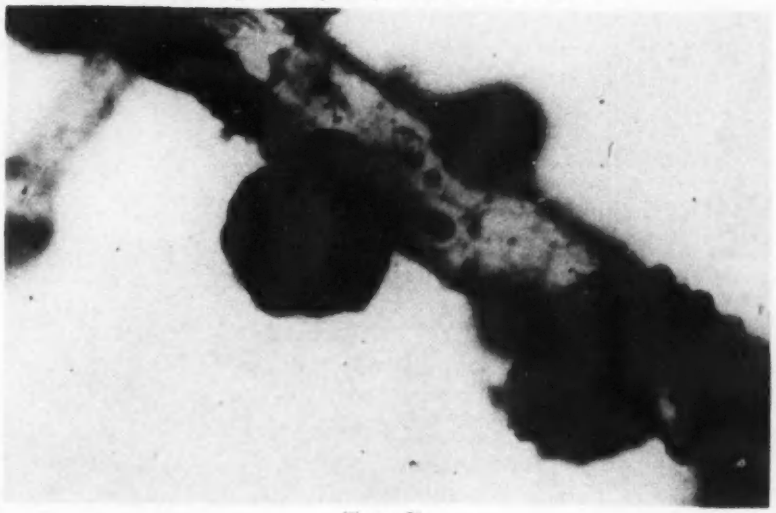


Figure 20
Same fiber and globule as in Figure 19 showing reduction in size of upper globule after 45 minutes at the boil.

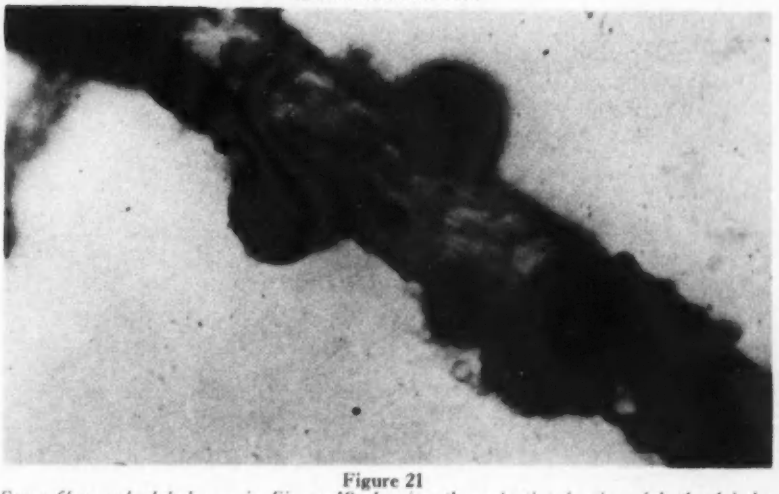


Figure 21
Same fiber and globules as in Figure 19 showing the reduction in size of both globules after 1½ hours at the boil.

[1] The chlorinating solution (21° C) contained 0.01% available chlorine and was adjusted to pH 4.5 with hydrochloric acid.

[2] Calcozine Red BX solution was prepared by dissolving 200 mg of dye in 1000 ml of distilled water. This solution has a pH of 3.35.

an irregular continuous film, which envelopes the fiber. If the alkaline medium is brought into contact with the chlorinated fiber on which the Allwoerden sacs were deflated by acid solution, the fiber appears to swell as the enveloping film expands. It has been found that treatment with the acid solutions mentioned above results in the total contraction of this film surrounding the fiber, as previously noted in Figure 26. Rinsing thoroughly with distilled water restores the film to its former state (Figure 27). This cycle of expansion and contraction may be repeated by use of the same procedure as with the original Allwoerden sacs.

This similarity in behavior suggests that the irregular apparently-swelling phenomenon observed when chlorinated wool is subjected to alkali attack is due to the complete separation of the epicuticle or other membrane *(1, 11)* as an irregular tube surrounding the fiber. A somewhat similar behavior is observed when untreated fibers are subjected to attack by sodium hydroxide solutions. In this case, however, the separation of the epicuticle or other membrane appears to be incomplete, giving rise to extreme irregularity in its tubular form.

Lindberg *(8)* has suggested that the epicuticle may be tucked under the edges of the scales like a folded cloth in a clothes peg. The individuality of the Allwoerden sacs may be due to failure of dilute chlorine solutions to release the epicuticle at these points of contact. Presumably, however, dilute sodium hydroxide solutions are able to bring about their complete release either by solvent action upon the binding material (endocuticle, cement, etc) or by the separation of the scales due to the swelling action of the alkali on the fiber. As a result of this release, the existing osmotic pressure within the epicuticle brings about the rapid conversion of the individual Allwoerden sacs to the continuous irregular film. It is perhaps of significance that the alkaline conditions under which the epicuticle tube is seen to be inflated are commonly associated with the well-known slippery or slimy feeling. It is also common experience that the slipperiness can be eliminated by acidification, which has been observed to be accompanied by the contraction of the inflated epicuticle. Presumably the gelatinous alkaline layer responsible for the sliminess has its origin beneath the epicuticle and is associated with the observed osmotic effect.

In the course of the experiments, it was observed that certain pouchlike projections appeared on the fiber and persisted through repeated successive treatments with dilute-acid hypochlorite, sodium hydroxide, and Calcozine Red BX solutions. These projections are shown in Figures 28, 29, 30 and 31. Although they were obscured by the inflated epicuticle obtained after each alkaline treatment, they became visible again after treatment with Calcozine Red BX solution, which caused contraction of the epicuticle film. The pouchlike projections were oriented in the same manner as scales detached along

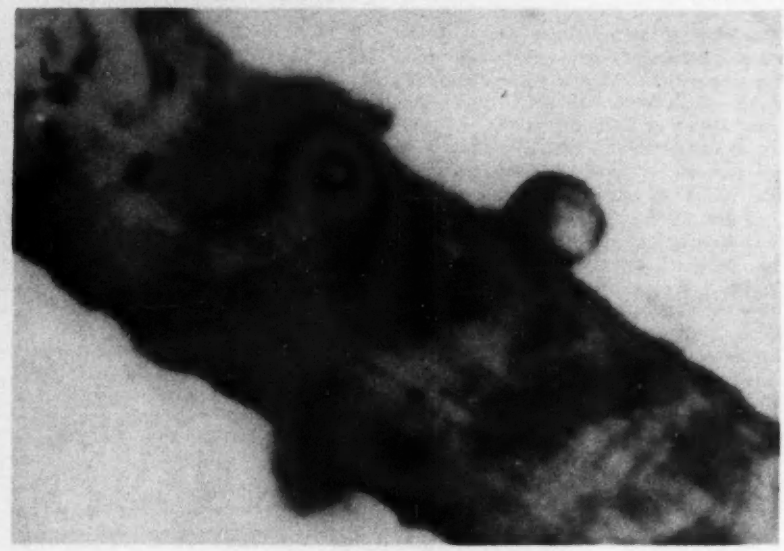


Figure 23

Two-phase effect observed within globule of fused precipitated dye-agent complex after boiling 45 minutes. Most of the dye has been removed from the globule.

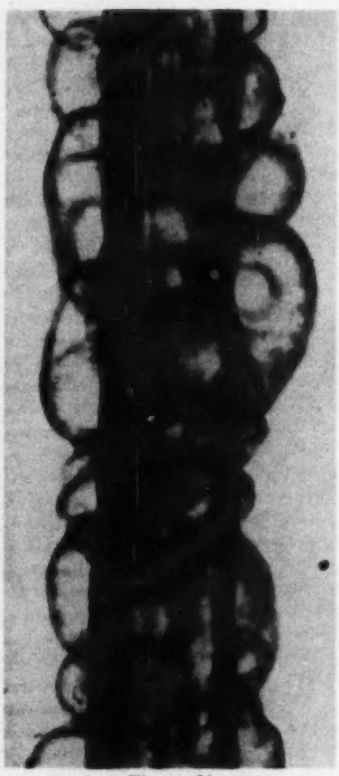


Figure 24

Wool fiber treated in acid chlorinating solution showing Allwoerden sacs.

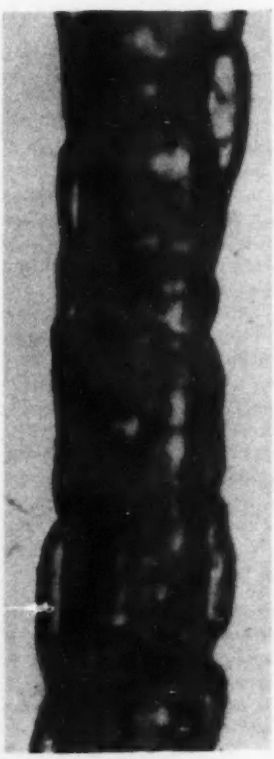


Figure 25

Same chlorinated wool fiber as shown in Figure 24 showing sacs partially deflated by treatment with dilute sulfuric acid solution.

Figure 26
Same fiber with sacs completely contracted and epicuticle restored to continuous contact with fiber surface.

Figure 27
Same wool fiber following treatment with dilute sodium hydroxide solution to detach and inflate the epicuticle or other membrane as a continuous tube surrounding the fiber. Note the rounded form of the outer surface of the membrane.

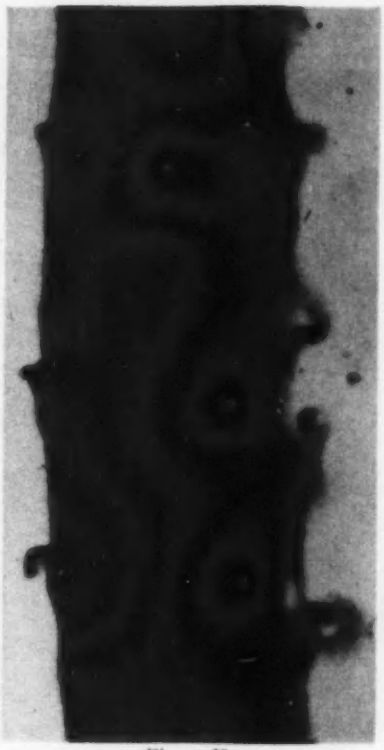


Figure 28
Wool fiber showing "pouch effect" (lower right-hand corner) after successive treatments with acid chlorinating solution, sodium hydroxide solution, and Calcozine Red BX solution.

Figure 29
Wool fiber showing persistence of "pouch" after 5 successive cycles of the treatment given the fiber in Figure 28.

Figure 30
Wool fiber showing "pouch effect" apparently associated with scale structure, after the same treatment as that given the fiber in Figure 28.

Figure 31
Wool fiber showing "pouch effect" (upper left-hand corner) with Allwoerden sacs fully inflated.

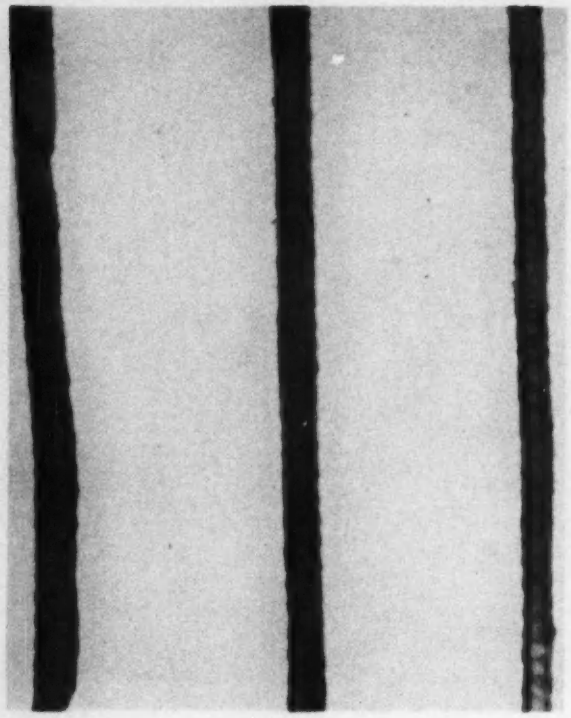


Figure 32
Three sections of a wool fiber colored uniformly with 2% Calcochrome Brilliant Blue BBG dyed top chrome.

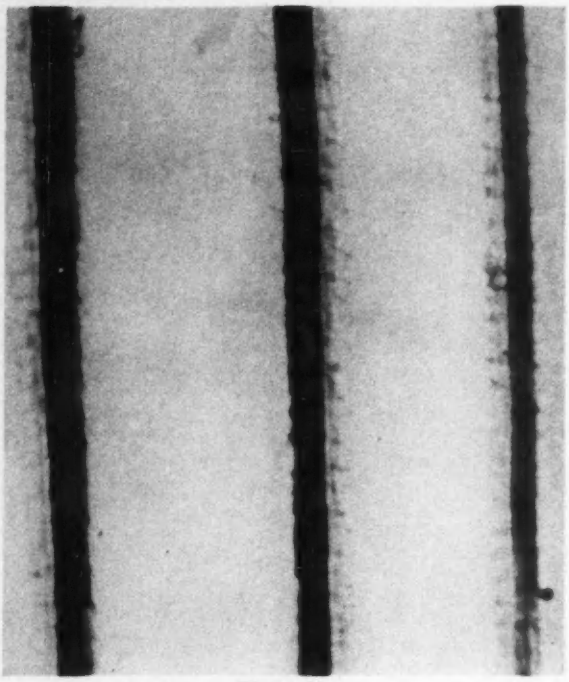


Figure 33
Same sections of fiber as shown in Figure 32 after 25 seconds' contact with the hypochlorite solution. Bilateral decolorization has taken place on one side of the fiber. Note presence of Allworden sacs protruding from sides of the fiber.

their distal edge. The chemical stability of these projections, indicated by their resistance to alkali, suggests that they are not identical with the substance of the endocuticle scales. Their form and position nevertheless indicates their close association with these scales, possibly as a layer underlying them.

CHLORINATION OF DYED WOOL TO SHOW A BILATERAL EFFECT ———Previous studies *(17)* have shown that individual wool fibers may exhibit preferential absorption of certain acid and milling dyes along one side of the fiber only. The undyed or lightly dyed portion of the fiber may then be colored by redyeing with crystalloidal types of acid dyes to produce bicolored effects within the same fiber. Certain dyes, eg, Calcocid Orange Y Ex Conc, CI 151, uniformly color all portions of fleece fibers, regardless of their condition. Other dyes, eg, Calcocid Violet 4BX, CI 698, are selective and, during the early stages of the dyeing, penetrate only the more accessible portions of the cortex.

Recent studies by Horio and Kondo *(6)* and Mercer *(12)* have shown by chemical treatments and by dyeing experiments that wool fibers possess an inherent bilateral structure, which extends their entire length. Mercer refers to the less stable, more reactive half of the cortex as the "orthocortex" and to the other as the "paracortex." The "orthocortex" is readily dyed. The "paracortex," however, is often much less easily colored. While it may dye readily in some cases, it remains undyed or only tinted in others, depending upon the properties of the specific dye that is used.

Microdyeoscopic studies have shown that uniformly colored fibers may also be decolorized preferentially along one side during the early stages of treatment with dilute hypochlorite solution. To illustrate this effect, scoured fleece wool was dyed with 2% Calcochrome Brilliant Blue BBG, CI 720, and top-chromed. A fiber was then mounted for treatment with a hypochlorite solution made by diluting 40 ml of Clorox (5.25% available chlorine) with water to one liter and acidifying with hydrochloric acid to obtain a pH of 4.2.

Figure 32 shows three sections of the same uniformly colored fiber in water only at 80°F. Figure 33 is a photograph taken 25 seconds after the chlorinating solution had come in contact with the fiber. Note that the dye has been decolorized along one-half of the section at the right. Figure 34, after 2 minutes of contact, shows this same section to be completely decolorized, while the others have been decolorized on one side only. Figure 35 shows a small amount of color remaining in two sections along one side of the fiber after 5 minutes of treatment. The fiber showed considerable swelling during the five minutes of treatment. Compare Figures 32 and 35.

BRONZING OF DIRECT COTTON DYES———Most dyers have experienced bronzing at some time or other. One known cause of bronzing is the precipitation of dye by the addition of excessive quantities of exhaustants. Bronzing generally occurs with those dyes which exhibit this optical characteristic in the solid state. A Microdyeoscopic study of the behavior of Calcomine Red 4BX, CI 448, was carried out, since this dye can be made to produce bronziness on textile materials when it is thrown out of solution by high concentrations of common salt. One and one-half percent of Calcomine Red 4BX (purified by the sodium acetate method) was dissolved and added to the dyebath. Fibers of cotton, viscose rayon and Bemberg rayon were mounted for observation in this study, in which a bath ratio of 60:1 was employed. Common salt, added at room temperature in increments of 10% on weight of fiber (owf) produced precipitation when a concentration of 70% was

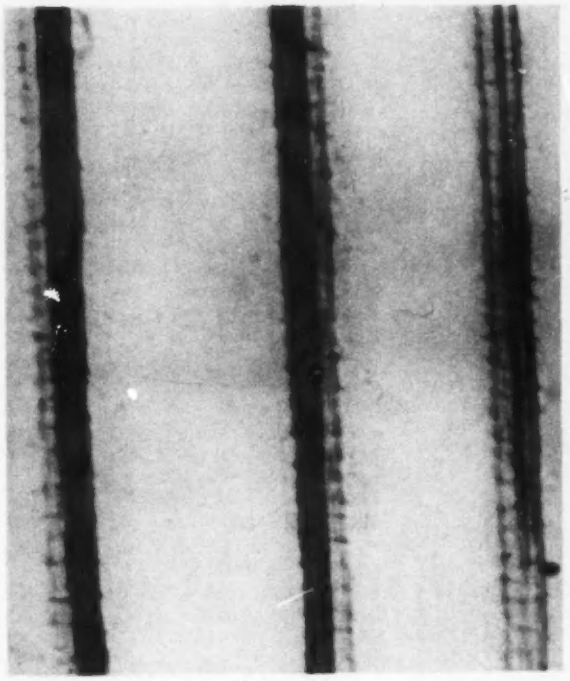


Figure 34
Same fiber after 2 minutes' treatment with hypochlorite solution showing complete decolorization of one section and bilateral effect in other two sections.

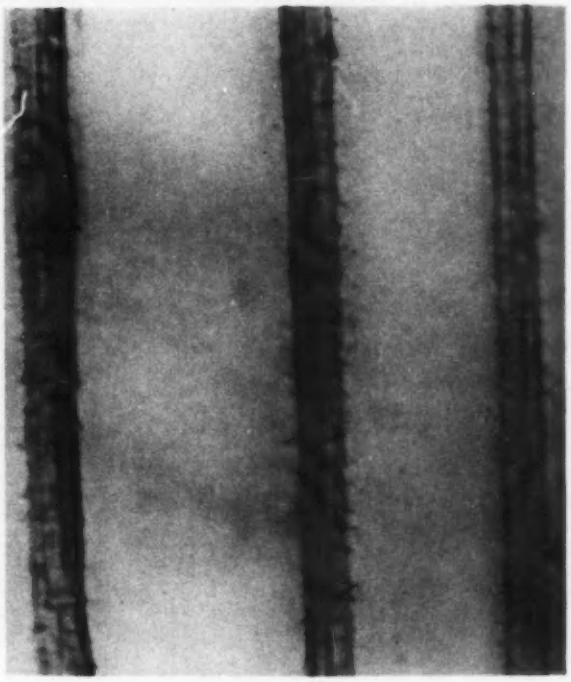


Figure 35
Same fiber after 5 minutes' treatment. Slight bilateral effect still visible in two sections of fiber. Note swelling of fiber as compared with Figure 32.

reached. A large excess of common salt (total 150%) was then added to ensure further precipitation and to retard the resolution of the precipitate as the temperature was raised. During the course of the precipitation, a fine dispersion of insoluble orange-yellow material was seen first in the dyebath. Within a short time a granular semigelatinous orange deposit formed on all fibers, while the color of the dyebath was reduced from its original deep yellowish red to a very pale orange. In time the fibers became enmeshed in a mass of precipitated orange-red material, which persisted with little change at 185°F (Figure 36). When the boil was reached, the precipitate had partially redissolved, with a substantial reduction in the mass adhering to the fibers (Figure 37). After 30 minutes' boiling, practically all traces of the precipitate had vanished, and the fibers were a deep red shade (Figure 38). If Calcomine Red 4BX is used in a dyebath having too low a liquor ratio or too high a concentration salt, however, the precipitate may remain on the material and produce the well-known "bronzing" effect when dried. This effect has been confirmed by the observation of fibers coated with the gelatinous precipitate and then dried. The presence of this deposit can also be demonstrated by an examination of the fastness to crocking. In cases of bronzing, the crock will be extremely heavy.

DIRECT ACETATE DYES——Considerable work has been done by Kartaschoff *(7)*, Clavel *(3)*, and Vickerstaff and Waters *(22)* to determine the mechanism involved in acetate dyeing. Kartaschoff found that in his microscopical studies the dye particles were strongly attracted to the fibers, forming a thick layer on their surface. After some time the layer had vanished and the fibers were uniformly dyed. He believed that electrical charges between the fiber and the dye caused the dye to coat the fibers, and that the dyeing is a direct result of this electrical attraction. Clavel believed that dyeing takes place from a very dilute aqueous solution, which is kept saturated by the breakdown of the large dispersed particles of dye.

A number of Calco acetate dyes have been studied in detail in the Microdyeoscope to investigate the mechanism of dyeing and to obtain direct experimental evidence to support one or another of these opposing theories. Continuous-filament acetate rayon was wound onto frames for observation in the cell. The dyes were pasted with a small amount of hot water and were added to the dyebath together with a long-chain alcohol sulfate and sodium pyrophosphate as dispersing assistants. The dyebath was then brought to 180°F in 20 minutes, and maintained at this temperature for 30 minutes, during which time the dyeing process was virtually completed.

In every dyeing a dispersion of insoluble particles, presumably dye, was observed in the cold dyebath immediately after the addition of the dispersed pasted dye. With certain dyes, the dyebath was also slightly colored at 95°F, while in other cases a light coloration of the liquor became evident only at 150°F. In a few cases no positive coloration was discerned in the dye liquor at any temperature. In every case the rise in temperature of the bath was accompanied by the development of color in the acetate fibers and by the gradual reduction and eventual complete disappearance of "insoluble" particles from the liquor during the dyeing process. In cases in which a visible coloration of the dye liquor had been observed, the disappearance of this coloration followed the disappearance of the insoluble particles. All fibers were dyed level, with no local selectivity observed between different fibers. The temperature at which perceptible coloration of the fiber was first observed appeared to be associated with the coloration of the dye liquor.

In none of these dyeings was any tendency observed for particles of dye to adhere to or to accumulate on the surface of the acetate fibers. Magnifications up to 430x were used to examine the surface of the fibers in these studies. Particles of dye were observed to drift past the fibers without any indication of attraction for the dye by the fiber, even

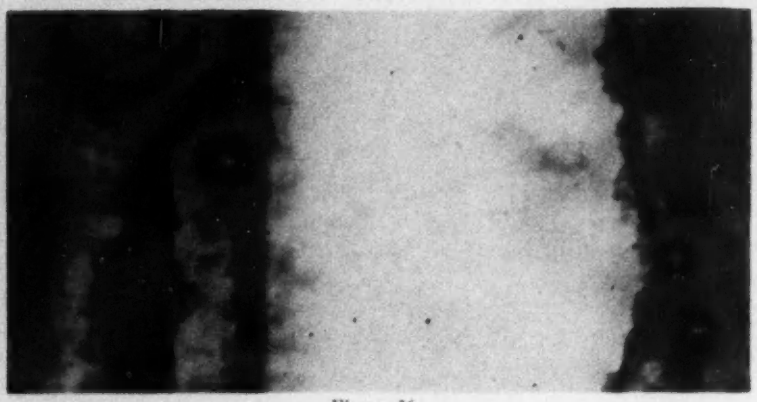


Figure 36
1½% Calcomine Red 4BX Conc dyeing at 185°F on rayon and cotton, showing copious gelatinous precipitate caused by addition of common salt. Dye is completely precipitated and dyebath is colorless.

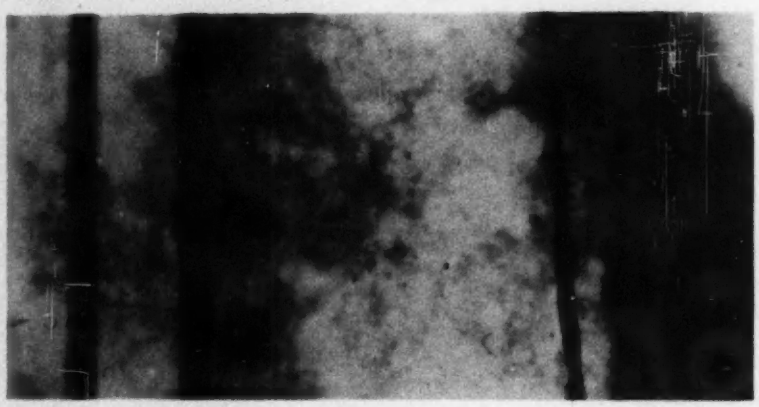


Figure 37
Same dyeing and fibers as in Figure 36, at the boil, showing precipitate partially redissolved and fibers dyed.

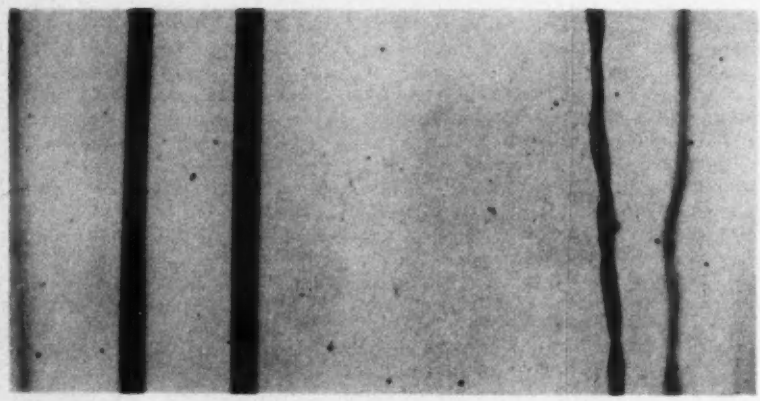


Figure 38
Same dyeing and fibers after boiling 30 minutes. The precipitate has redissolved during this period, and the fibers are heavily dyed.

though the rate of flow was reduced to zero. Frequent collisions between particles and fibers were observed, without any adhesion or apparent attraction in any instance. As supporting evidence against the adherence of particles of solid dye to the fiber, crocking tests were made on a series of samples of fabric dyed in identical baths of 1½% Calco Acetate Bordeaux Ex but removed, respectively, from the dyebath at 100, 120, 140, 160, and 180°F and after 5, 10, 20, and 30 minutes dyeing at 180°F. The samples were dried without rinsing and were subjected to both wet and dry crocking tests. No critical crocking points were observed, and all samples exhibited approximately the same degree of resistance to crocking. These observations are in agreement with Clavel's suggestion of aqueous solution as an intermediate step in acetate dyeing and confirm the observations of Vickerstaff and Waters *(22)*.

Two dyes of considerably different properties may be cited as examples to illustrate the range of behavior: Calco Acetate Orange G Ex Conc, Pr 43, a dye of fine particle size; and Calco Acetate Bordeaux Ex, Pr 238, a dye of coarse particle size. Both dyes were pasted with water and dispersants prior to addition to the dyebath. With 1½% of the Orange G type, coloration of the dye liquor and the fiber was apparent at 80°F, with numerous fine particles dispersed in the bath. At 120°F light yellow coloration was apparent in the fiber, and at 140°F, this had deepened to a golden shade, with an obvious reduction in the number and size of particles dispersed in the bath. At 160°F the dyebath was virtually free of visible particles but was still pale orange in color. At 180°F the dyebath had become practically colorless and the fibers had developed a full golden-yellow shade.

In contrast to the Orange G, 1½% of the Bordeaux Ex type produced an almost turbid suspension of large particles in a colorless medium at 80°F. As the dyebath temperature was raised to 140°F, little change was observed, but slight coloration of the fiber was noted at 160°F. At 180°F this coloration had deepened to a red shade and a large reduction in the size and number of dispersed particles was noted. Throughout this entire period the dyebath was but very faintly colored. Particles remained visible in the bath for more than 20 minutes at 180°F, but had disappeared entirely after 30 minutes at this temperature. Likewise, the very faint coloration noted earlier in the dye liquor had also disappeared.

VAT-PIGMENT DYEING OF RAYON TOPS———Many studies on the application of vats to various fibers have been made in the Microdyeoscope, only one of which will be described in detail. The author is indebted to S J Luscian *(10)* for the following practical dyehouse data on the application of vat dye to viscose rayon:

VAT DYEING

PIGMENT METHOD
ABBOTT TOP MACHINE
400 lb Viscose Rayon

Temp °F	Additions	Gauge lb/sq in
90	7% pigment	4.4
120		4.0
160		3.6
180		3.5
200		3.5
200	25% salt, 15' pigment nearly exhausted	4.8
200	10% NaOH, 15'	4.4
200	5% $Na_2S_2O_4$, 10'	3.0
200	5% $Na_2S_2O_4$, 10'	2.8

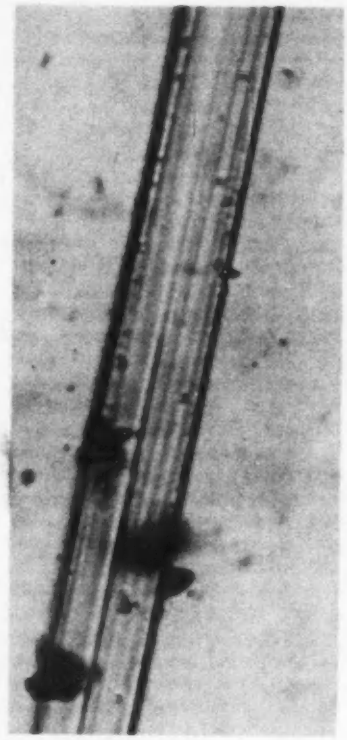


Figure 39
Appearance of rayon fiber and pigment dyebath after running 15 minutes at 140°F. The dark material in the background is vat-pigment particles.

Figure 40
Rayon fiber covered with vat-pigment particles after the addition of 25% common salt

Figure 41
Rayon fiber 5 minutes after the addition of caustic and hydrosulfite at 140°F. Note reduction in amount of vat-pigment particles on fiber.

The above procedure was repeated in the Microdyeoscope with 5% Calcoloid Violet 6RD Double Powder to determine the conditions of the fiber and dyebath which were responsible for the wide fluctuations in gauge pressure. Figure 39 shows the appearance of the fiber and the pigmenting dyebath after running 15 minutes at 140°F with dye only. A few dye particles are visible on the fiber and in the bath. The temperature was raised gradually to 200°F, and 25% of common salt was added gradually. Within a short period of time, the fibers were covered with vat pigment and the dyebath exhausted quite rapidly (Figure 40). Such a concentration of particles on each fiber would tend to fill the spaces between the individual fibers and offer greater resistance to the flow of the dye liquor through the mass, hence the pressure on the gauge would rise.

Upon the addition of caustic soda and hydrosulfite at 180°F, the bath changed from a violet tint to yellow and a diminution in the number and size of the vat-pigment particles was noted within a very short time. Figure 41 shows the condition of the fibers 5 minutes after the addition of the caustic and hydrosulfite. The reduction and solubilization of the pigment particles removed them from the surface of the fiber, and in a large scale dyeing this would permit the liquor to flow more freely between the fibers and hence the pressure on the gauge would drop. Kodachrome photographs show the fiber in Figure 41 to be tinted yellow (the leuco shade of Vat Violet 6RD) and the attached particles of pigment, to be violet. At ten minutes the fiber is considerably yellower and only a few light-colored violet pigment particles remain on the fiber.

Dyeing was continued at 180°F, for 30 minutes, at which time all sections of the fiber were yellow and devoid of pigment particles, indicating complete reduction of all the dye (Figure 42). The dyeing was rinsed, oxidized and soaped (Figure 43).

This study was made to show the action of common salt when it is added to a vat pigment dyebath. It is difficult to obtain uniform distribution of pigment under practical dyeing conditions and therefore additions of common salt must be made carefully if level pigmentation is to be obtained.

Microdyeoscopic studies have also shown that methods which leave unreduced pigment particles on the fibers will produce dyeings that crock excessively. Complete reduction and solubilization of the vat pigment is essential in order to obtain the maximum potential fastness of vat dyes.

DYEING DYNEL USING PARAPHENYLPHENOL AS CARRIER——Carriers are important adjuncts to the dyebath in the coloring of certain hydrophobic fibers. An addition of paraphenylphenol to a cuprous-ion dyebath in the application of acid and milling dyes to Dynel is known to produce deeper shades. Little is known about the function of carriers in dyebaths at the present time. Our studies have revealed some hitherto unsuspected properties of carriers, one of which will be described in detail.

A dyeing of Dynel was made in the Microdyeoscope with 3% Calcocid Milling Red 3R Conc, CI 275, by a cuprous-ion procedure plus carrier. Two and one-quarter percent of par·phenylphenol owf was dissolved with an addition of caustic soda and added to the dyebath at room temperature. The dyebath was clear until an addition of 4% acetic acid, 28%, was made, the bath becoming milky immediately. As seen through the microscope, the bath was filled with tiny, transparent, colorless, acicular crystals, which were devoid of affinity for the fiber (Figure 44). No change in the appearance of the bath or the crystals was caused by the sequential addition of 2% cupric sulfate and 0.8% zinc formaldehydesulfoxylate. When 3% of Calcocid Milling Red 3R Conc was added to the bath, the crystals became

Figure 42
Rayon fiber after 30 minutes at 180°F. Dye is in complete reduction and fiber surface is free of pigment particles.

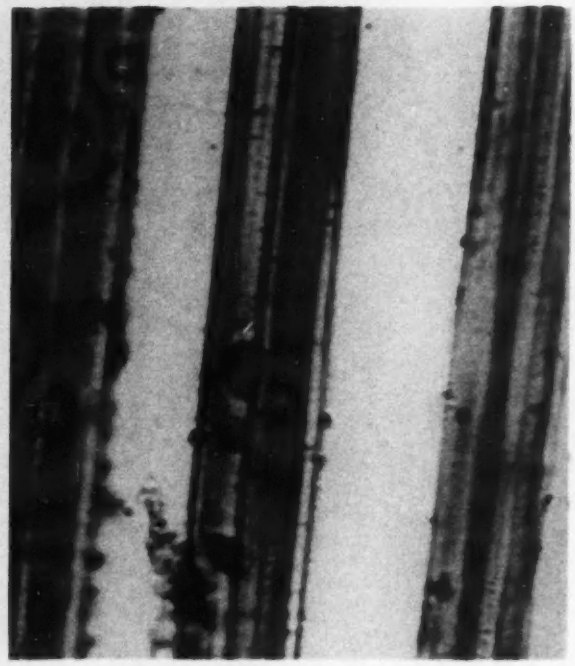


Figure 43
Fiber after rinsing, oxidation and soaping.

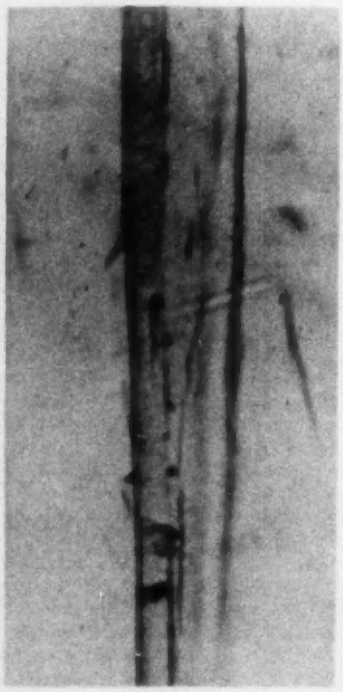


Figure 44
Appearance of Dynel fiber and dyebath containing paraphenylphenol after an addition of acetic acid. The bath is filled with colorless acicular crystals (darker streaks in background), which have no affinity for the Dynel.

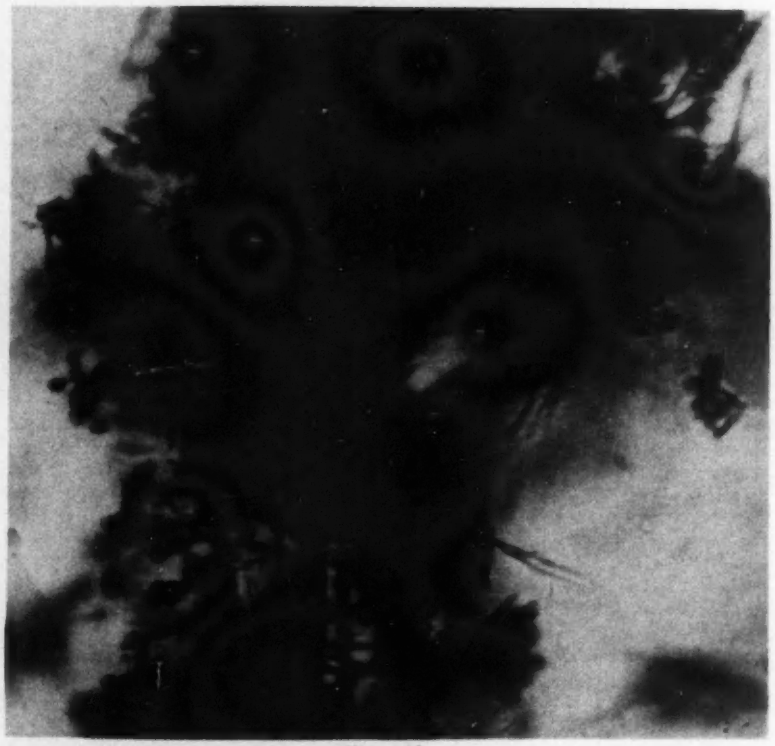


Figure 45
Appearance of Dynel fiber and dyebath after the addition of 3% Calcocid Milling Red 3R. The crystals of paraphenylphenol and dye reacted to form large crystal aggregates, which have affinity for the fiber.

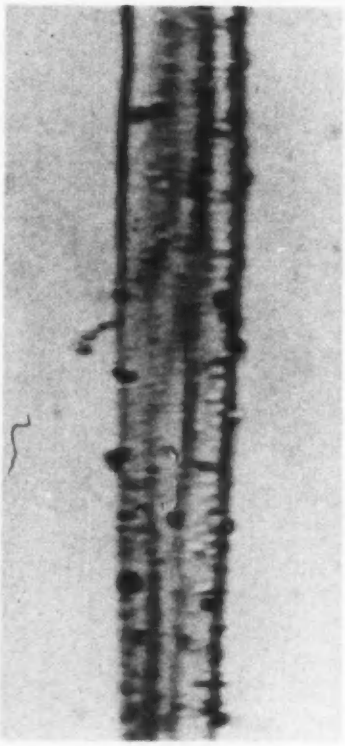


Figure 46
Appearance of Dynel fiber and dyebath at 180°F. Crystals have dissolved and the fiber is dyed.

colored immediately, increased in size and had such great affinity for the Dynel that the fibers were completely surrounded by large aggregates or mats of brown crystals within a few seconds (Figure 45). As the temperature was raised slowly from 75 to 120°F, the hue of the crystals changed from yellowish brown to brownish red. By the time the temperature of the bath had reached 155°F, the bath was red and the fibers were free of crystals, although a few were visible in the dyebath. Some absorption of dye by the fibers was observed. At 180°F all of the crystals had dissolved, the bath was red, and the fibers were deeper in shade (Figure 46). After boiling 30 minutes, an addition of 2% formic acid was made to complete the exhaustion of the dyebath.

Studies with several other carriers and fibers indicate that they react with or dissolve the dye during the dyeing cycle.

TECHNIQUE FOR WINDING FIBERS ON FRAMES——Many requests have been received for a description of the techniques used to incise fibers and also to attach them to the frames.

This work can be carried out best on a smooth, flat piece of black velveteen or other low-pile fabric. A tensioning weight attached to one end of the fiber aids in the close spacing of the fiber during winding. A pen point was found to be ideal because pressure on the point spreads the sections apart so that the fiber can be placed between them. When the pressure is released, the fiber is held firmly between the two sections of the pen. Drawings A through F in Figure 47 show the different steps in tying the fiber to the frame.

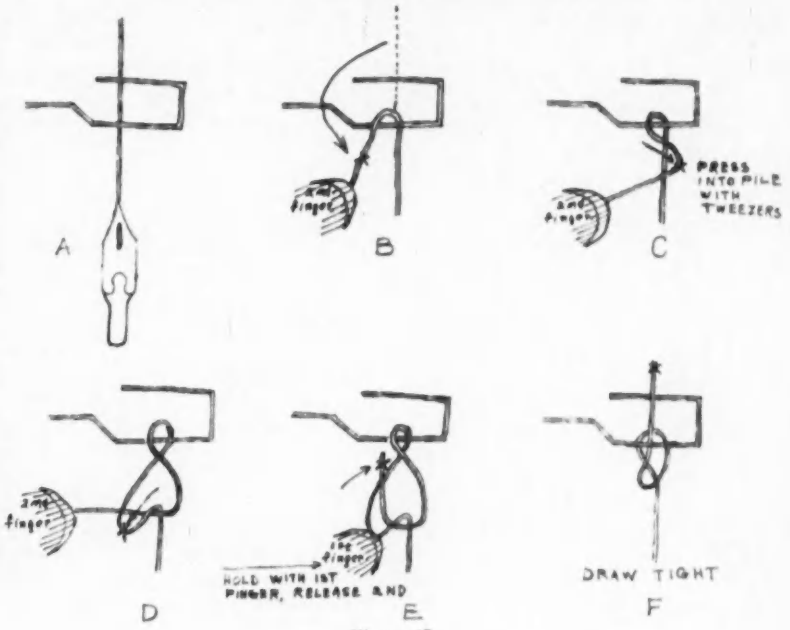


Figure 47
Tying Knots.

A——Attach pen to one end of fiber and lay it in the black velveteen. Place frame over fiber about 1 inch from upper end.

B, C, D, and E——Fiber is held on pile fabric with fingers of left hand, while right hand with tweezers carries fiber through knot formation. The x on the fiber indicates point held by tweezers.

F——Draw knot tight at proper position on frame. Wind fiber on frame by rotating frame, allowing pen point to hang on free end of fiber. Apply a minute amount of fluid cellulose acetate to attach free end to frame. Cut ends with small scissors.

INCISIONS IN WOOL FIBERS——Incisions in wool fibers make it possible to observe differences in the rates of diffusion of dyes through the incised and normal areas. Wool fibers may be incised by following the steps described below and illustrated in Figure 48:

A) Cement a microscopical cover glass to one end of a glass slide.

B) Lay fiber over slide about one inch from the cover glass.

C) Place one end of a new single-edge razor blade about $\frac{1}{8}$" to 3/16" beyond fiber and

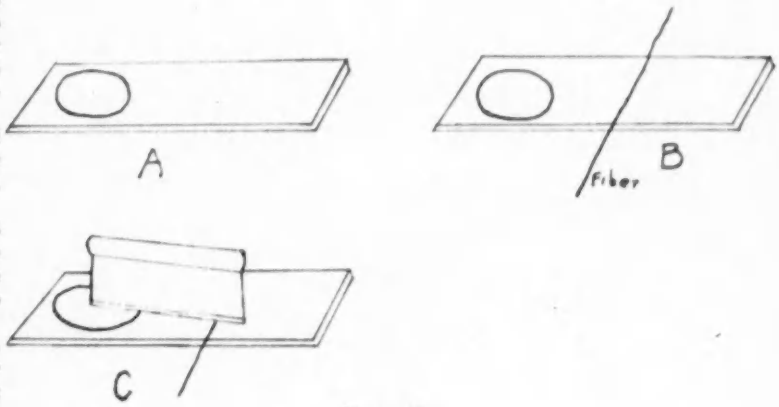


Figure 48
Incising Fibers.

lower other end to touch cover glass. The blade is moved through a small distance sideways to check contact with fiber. If contact with fiber is not observed, repeat C with end of blade a little closer to fiber. The size of the fiber will determine the best distance, as shown in C. While incisions are being made, fiber should be held at either side of slide with fingers of left hand. The most useful incisions are those which cut about halfway through the fiber.

ACKNOWLEDGMENT

The author wishes to express his appreciation to L H Turl, co-inventor of the Microdyeoscope, and with whom many of the studies described herein were made.

Thanks are also due to S Mooradian, J C Leininger, J J Black, and W J Clark for assistance in certain of the dyeing experiments; to R H Kienle, A L Peiker, and C A Amick for helpful criticism of the text; and to C Maresh, Miss Florence Gustafson and Bernard Barkouskie for preparing fiber mounts and printing photographs for use in illustrating this paper.

* * * * * *

NOTE: The Microdyeoscope is not manufactured as a unit. It may be readily assembled with parts purchased from the suppliers listed below. The prices shown are as of January 1955:

Glass Dye-Chamber Unit

Scientific Glass Apparatus Co, Ackerman Street, Bloomfield, N J. Price, $10.00, fob destination.

Microdyeoscope Cell

Edwin Skidmore, Central Avenue, Mountainside, Westfield, N J. Price, $110.00, delivered in USA.

Micro Ibso

E Leitz, Inc, 468 Fourth Avenue, New York, N Y. Price, $110.00.

Leica Camera (without lens) & Micro Ibso

May be purchased as a unit from E Leitz Inc. Price, $175.00.

Nichrome Wire for Fiber Frames, Size 0.020 Millimeters

Driver Harris Co, Harrison, N J.

LITERATURE REFERENCES

(1) Alexander, P, and Earland, C, *Textile Research J* 20, 298 (1950).
(2) Allwoerden, K von, *Z Angew Chem* 29, 77 (1916).
(3) Clavel, R, *Rev gen mat color* 29, 95 (1924).
(4) Gralen, N J, *J Soc Dyers Colourists* 66, 465 (1950).
(5) Hock, C W, Ramsay, R C, and Harris, M J, *Am Dyestuff Reptr* 30, 449 (1941).
(6) Horio, M, and Kondo, T, *Textile Research J* 23, 373-386 (June 1953).
(7) Kartaschoff, V, *Helv Chim Acta* 8, 928 (1925).
(8) Lindberg, J, *J Textile Inst* 19, 45 (1949).
(9) Lindberg, J, Mercer, E H, Philip, B, and Gralen, N, *Textile Research J* 19, 673 (1949).
(10) Luscian, S J, Private communication.
(11) Maresh, C, and Royer, G L, *Textile Research J* 19, 449 (1949).
(12) Mercer, E H, *ibid* 23, 388-401 (June 1953).
(13) Millson, H E, and Turl, L H, *Am Dyestuff Reptr* 39, 647 (1950).
(14) Millson, H E, Watkins, W H, and Royer, G L, *ibid* 36, 45 (1947).
(15) Millson, H E, and Turl, L H, *Textile Research J* 21, 685-702, (October 1951).
(16) Royer, G L, Millson, H E, and Amick, C A, *J Soc Dyers Colourists* 63, 214 (1947).
(17) Royer, G L, and Millson, H E, *Am Dyestuff Reptr* 29, 697-704 (1940).
(18) Snyakman, J B, and Goodings, A C, *J Textile Inst* 17, 607 (1926).
(19) USP 2,443,166, by H E Millson and G L Royer, June 8, 1948 (to Am Cyanamid Co).
(20) USP 2,520,105, by H E Millson, W H Watkins, and C A Amick, Sept 22, 1950 (to Am Cyanamid Co).
(21) USP 2,589,674, by Cook, E W and Moss, P H (to Am Cyanamid Co).
(22) Vickerstaff, T, and Waters, E, *J Soc Dyers Colourists* 58, 116 (1942).

AATCC Monograph No. 2

"THE APPLICATION OF VAT DYES"

"The group of fifteen editors responsible for this monograph consists of a well-balanced cross-section of American industry concerned with the production, marketing and application of vat dyes. The AATCC is to be congratulated on the production of a comprehensive survey of American vat dyeing and printing practice which is the major theme of this application . . . the book will be useful as a work of reference at this side of the Atlantic and as a working manual for the American colorists for whom it was designed. . . . If a clear account of American practice is required . . . the enquirer must have access to this volume."—*JOURNAL OF THE TEXTILE INSTITUTE* (England).

"This book . . . is abreast of the latest technical developments and research. Its value is increased because of the lack of books in this field today . . . we can readily recommend this book to all technical and practical men"—*MELLIAND TEXTILBERICHTE* (Germany).

"This monograph contains the work of many mill-experienced authors, plus good, sound chemical and application principles developed in the laboratories and mills enjoying AATCC membership. . . . This book puts between two covers much information that a dyer is constantly searching for. It is a good investment for any laboratory, dyehouse, or printshop."—*TEXTILE WORLD.*

". . . this monograph should be in the hands of every user of vat dyestuffs, every student and every teacher. The book is well indexed and includes valuable lists of equivalent trade names. It will certainly take its place as a standard book of reference."—*JOURNAL OF THE SOCIETY OF DYERS AND COLOURISTS* (England).

$5.00, postpaid, to members
$6.00, postpaid, to nonmembers

SEND CHECK OR MONEY ORDER TO

DR H C CHAPIN, SECRETARY, AATCC
PO BOX 28 • LOWELL, MASS

LADIES' NIGHT MEETING

WESTERN NEW ENGLAND SECTION

MAY 13, 1955

WAVERLY INN, CHESHIRE, CONN

(Photos by A N Henschel)

Clarence Seibert (left), golf chairman, congratulates R C Brown, winner of the golf tournament

PHILADELPHIA SECTION OUTING

•

MAY 20, 1955

•

MANUFACTURER'S GOLF & COUNTRY CLUB ORELAND, PA

J Lord tries his hand at darts as Ed Diehl and Leo Clark supervise

(All captions read left to right)

Ed Smith, Jack Allen, Jim Rishton and F McCawley Tolin

Bob McFarland, Carleton Anderson, Ely Hawkins and Ed Bride (driving)

A Oberholtzer, Bob Oberholtzer, Ed Jones and Pete Wolf (18th green)

Brownie Lisowski, Warren Shenk, Robert Granprior and Joe Clark

(All captions read left to right)

Seated: Fred Traut, Al Stutzke, Ange Raimo and Ed Haack. Standing: John McChesney, Don Robinson, Percival Theel, Kevin McChesney and Ernst Empting

Frank Nevins, Dick Kopp, Lew Meyers, Bill Frye and Tom Scanlan

Tom Holst, Ed Haack, J W Fricke, Hubert Hoffmann, Clarence Seibert and Al Frank

Frank Frey, Mike Galcone, Al Morrell, Ange Raimo, Roy Hamilton, Dick Nickerson and John Quigley

Ed Diehl, Ernie Burrell, Dick Jones, Ange Raimo, Wash Smith and Ted Atkins

D L Keefer, Ben Holst, Harry McCandless, Wash Smith, Ed Keys and R Kopp

A new column on "Convention News" will be inaugurated in the next issue of ADR to keep you up-to-date on the forthcoming Annual Meeting in Atlantic City. Watch for it!!!

LADIES' NIGHT MEETING

•

RHODE ISLAND SECTION

MAY 13, 1955 • SHERATON BILTMORE HOTEL • PROVIDENCE, R I

(Photos by John E Tre-ise)

Book Review

TECHNOLOGIE DER FAERBEREI UND TEXTILVEREDLUNG

Dr Ing Albert Schaeffer. Verlag Melliand Textilberichte, Heidelberg, Germany, 1954. xx+808 pp, 4 indexes, 165 illustrations. Price DM73.80. Obtainable for $17.75 from Stechert-Haffner, Inc, 31 East 10th St, New York.

When the first edition of Albert Schaeffer's "Handbook of Dyeing", Volumes I and II, 1949, was sold out, it was imperative that he make a major effort to bring the material up to date, because so many new fibers, so much new equipment, and so many new methods for the textile dyeing and finishing industry had been developed after the War. Schaeffer therefore decided not only to modernize his handbook, but also to change its name, to change publisher, and to confine his efforts initially to the first volume, the one that is most important to the practical dyer and finisher because it is the working part of his treatise. This has now appeared without a volume number under the translated title of the "Technology of Dyeing and Finishing" in the form of a book printed in slightly smaller but readable type on smooth book paper and bound in a stiffer, more serviceable cover.

The new volume contains the same general material as its predecessor in three parts, A, B, and C. Part A opens with a consideration of the characteristics and properties of natural, regenerated, and wholly synthetic fibers, including virtually all of those that most of us are interested in except cellulose triacetate (Arnel), which is so new that it has hardly yet reached the retail market. This portion of the book gives a succinct survey of the manufacture of textiles that should be most helpful and instructive to those students, dyers and finishers who want to gain a quick general knowledge of carding, combing, doubling, spinning, sizing, weaving and knitting; it is not really meant for specialists already acquainted with those fields. The chemical preparation of textiles for dyeing and finishing is also taken up in this portion of the book under such subheadings as desizing, scouring, bleaching, mercerizing, optical whitening, oiling, and carbonizing. Part A concludes with the general finishing of textiles (exclusive of coloring), the following topics being among the subjects discussed: decatizing, fulling, making water-repellent, crease proofing, shrink proofing, stabilizing, general resin finishing, Sanforizing, fireproofing, rotproofing, mothproofing, and delustering.

Part B takes up the classification of dyes, both with respect to chemical nature and uses. An explanation of the various letter symbols used in dyestuff nomenclature, such as B, D, G, R, S, L, etc, will interest the beginner. Here also is a list of dyestuff trade-marks from manufacturers all over the free world and the type of color to which each refers. In the back of the book is a catalog of former IG dyestuffs and the corresponding new names given by the present independent manufacturers that were formed out of the dissolved IG. This is a feature of the book that is difficult to find elsewhere. Fastness properties, especially light fastness, and standard depths of dyeings are also discussed in Part B.

Part C, which constitutes more than 60% of the descriptive material of the book, discusses the dyeing of all fibers in all stages of manufacture from fiber to fabric in all types of equipment. The subject of printing is not included. It would take too much space here to outline all the topics covered, but it should be explained that first the general application of every class of dyestuff is discussed for the fibers for which they were originally intended. The directions for each class are quite complete and, in many instances, as for example vat dyes and naphthols, contain quantitative details of application in tables. On the other hand, it could hardly be expected that the information in a book of this type would be so complete for any specific dyestuff, especially with respect to uses and fastness properties, as that to be found in an individual circular, even though principles receive fuller treatment. In this part, stock, yarn and piece dyeing all receive attention, particularly new continuous methods and all kinds of wet-processing equipment without needless repetition of directions already given. The dyeing of the new fibers is covered reasonably well with the information known up to early 1954. Part C also discusses briefly the purification of industrial water, dyeing to shade, and the extraction and drying of textiles. It concludes with 8 pages of tables which indicate the magnitude of the textile industry in different countries in recent years.

That the author has included much more material in the new edition than in the old Vol I is attested by simple statistics: the number of words has been increased by probably a generous fourth, the number of illustrations by 5%, and the number of references by perhaps six times to 4300. The following are a few of the fiber types discussed in the new volume but not in the old: Acrilan, Dacron (Terylene), Celcos, Dynel, Fortisan, peanut-protein, soybean-protein, algin, polyethylene, polyvinyl-alcohol, Orlon, Vicara and Saran. A few of the important dyeing machines, dye classes, and processes introduced and described are the Standfast Machine, the various Williams machines, pad-steam vat dyeing, Vat Craft process (a promotional rather than practical development), Bond Machine (not yet in mill production), continuous vat-acid procedure, neutral-dyeing metal-complex acid dyes for wool, naphthol dyeing on acetate and polyamide fibers, control of redox potential, carrier method for Dacron, cuprous-ion method for acid dyes on acrylic fibers, Barotor, high-pressure package machines, etc.

The information in Schaeffer's book is presented in a very clear and simple manner, which makes reading and understanding easy. The author fortunately defines and explains new words and concepts as he goes along, so that especially students and beginners in dyeing and finishing will readily follow all explanations.

A most valuable feature of the book, which was not nearly so complete or well organized in the old and which surpasses similar efforts in most books on dyeing, is a large bibliography of journal articles and books selected from the literature of American, English, French and Swiss as well as German sources dating mostly from the late thirties well into 1954. These references, which are appropriately placed at the end of every division or section of the book, serve as a splendid index of the most important literature of recent years, including even some references from the 1920's.

Although this volume is quite encyclopedic and refers to most things the dyer will look up, the treatment of a few topics in a book even as large as this one is disappointing. For example, it would seem that a book of this type should evaluate more critically the advantages and disadvantages of different dyeing procedures and equipment to guide the expert. The description and advantages of the hot-flue dryer are quite inadequately covered. The use of Astrazon, Genacryl, or Sevron basic-type dyes for dyeing Orlon is not mentioned, nor are the Derby method of drycleaning raw wool continuously and the removal of cellulosic burrs from raw wool by freezing. The discussion of shoddy fails to distinguish between reused and reworked wool. The method of classifying direct dyes in dyeing behavior proposed by Lemin, Vicker, and Vickerstaff in 1946 should have been mentioned, both in the discussion and in the bibliography. It is certainly not true in America that indigo is no longer important since tremendous quantities of cotton are being dyed and will probably continue to be dyed with indigo. Relatively few serious mistakes of facts are evident in the book, however, and there are less than the usual number of typographical errors. A maximum height of 5 meters for the cotton plant was nevertheless startling.—CZD

ABSTRACTS

The Role of Heterogeneous Swelling in the Formation of Certain Wool Properties

M Zihali and O K Dobozy, *Acta Technica Academiae Scientiarum Hungaricae* Tomus IX, Fasciculi 1-2 (1954).

The authors have devoted this work to the development and characterization of crimp in wool. Subsequent to a cursory resume of papers previously published on this subject, they have listed nine questions as being still unclear. All through the thesis there is repeated reference to work previously undertaken on specific items. The experiments were confined to wool from selected specimens of Hungarian sheep. The nine questions requiring answers are as follows:

1) What is the shape of the waviness of wool?

2) Does a relation exist between the inflection radius and the fiber diameter?

3) Does a relation exist between the number of waves per unit of axis length and the inflection radius or the fiber thickness, respectively?

4) Does a relation exist between the ratio of the waveline length to the wave length and the fiber thickness?

5) In how far are the data characterizing the crimp typical, taking into consideration the extent of the dispersion?

6) Are the factors characterizing the crimp permanent properties of the wool fiber?

7) If the factors characterizing the crimp are not permanent properties of the wool fiber, would the circumstances which would otherwise affect the swelling change the crimp? How would they change it?

8) What makes the wool fiber curl?

9) What is the role of wool crimp in felting?

Quantitative measurements were made to substantiate the opinions submitted in answer to these questions.

The crimp of a wool fiber can be defined with the aid of three characteristics:

1) The number of crimps per axial unit length.

2) The length of an individual crimp.

3) a) The inflection radius.

b) The length of the straight line portion between the radii vs curvature of a crimp.

The authors have determined a relation between the inflection radius of the wool crimp and the diameter of the fiber.

The internal fiber characteristics governing the shape of the crimp are not stable and vary along with the factors which determine the swelling potential of the fiber. Therefore, it can be stated that the crimp forms are dependent upon the swelling characteristic of the fiber. This curvature or crimp-shape change function, that is, the slope or inflection produced under a given relative humidity can be expressed in one of two ways: 1) that instance where the humidity alters the curvature to a more linear appearance, and 2) when the opposite effect is noted.

The results of mathematical and experimental analyses assume the fundamental effects producing the crimp to be the non-uniform distribution of a more or less oriented portion of the Ortho and Para cortex. The crimp forms are dependent upon the varying stability of these portions during the development period as determined by humidity conditions.

There are certain swelling conditions whereby the less oriented proteins swell to such an extent that at these places a new crimping force develops, which forces the waves in the opposite direction. These conditions are found in water or aqueous solutions, the effect is speeded up if movement is included, and then the fibers which are close to each other become entangled.

This crimping, which is inherent in the structure of the wool fiber, is the primary characteristic for the felting property of a fiber. The entanglements that occur during this felting process resist the return of the fiber to its original position. (The original article is in English).—WFB

Application of Silicone Water Repellents to Cotton

Alton A Cook and Nat C Shane, *Textile Research J* 25, 105, January, 1955.

The highly successful application of silicone water repellents to fabrics made from synthetic fibers led to consideration of their application to cotton fabrics. Some recent work with Hydro-Pruf* at the laboratories of the Arkansas Company, Inc, and also at a few dyeing and finishing plants, has yielded some interesting although incomplete data.

The outstanding advantage of the use of silicone water repellents is that they may be applied on the conventional equipment found in most textile mills. Analogous to the application of thermosetting resins, a high temperature curing in the presence of a suitable catalyst is essential. For the application of Hydro-Pruf to cotton, a temperature of 320°F for a minimum of five minutes is required. The type of silicone found to be most satisfactory is one which contains a high proportion of methyl hydrogen polysiloxane.

The matter of evaluation of durability to laundering is one of the most important factors to be considered, particularly in reference to cotton fabrics. There is no generally accepted standard for a washing procedure in this connection, but at the present time each manufacturer or mill sets up what it believes to be a satisfactory standard procedure.

At the Arkansas Company's laboratories, a wash test generally regarded as moderately severe, using 0.5% of anhydrous soap at 160°F for 90 minutes (1.5 hours), has been employed on cotton fabrics treated with silicone water repellents. Many types of Hydro-Pruf-treated cotton fabrics show a spray rating of at least 70 after such a wash.

Another procedure for laundering, viz, Method #5518 in Federal Specification CCC-T-191b, was used on several fabrics treated with silicone water repellents. This method uses a sour consisting of a mixture of sodium silicofluoride and sodium acid fluoride in the next to last step, and it was found that this sour affected adversely the durability of silicone water-repellent finishes. A detailed study of this method indicated that good resistance was obtained when the sour was omitted.

Evaluation of durability to drycleaning is perhaps not as important as laundering in the case of cotton fabrics, and a treatment with Stoddard Solvent or Varsol in a tumble jar for one hour at room temperature appears to be general practice.

Many types of cotton treated with Hydro-Pruf were found to give a spray rating of at least 80 after such a drycleaning test.

A study of the relationship of the silicone content of the fabric to laundering and drycleaning durability has indicated that in most applications a range of 0.75% to 1.25% is required. The exact amount which can be regarded as minimum in any particular application, will vary to some extent depending on the weight and construction of the fabric and, also, on the type of laundering procedure involved. Functional performance should be regarded as more important than a mere figure for silicone content.

The effect of resins, particularly those of the methylated melamine-formaldehyde type when used with Hydro-Pruf, has been studied in a preliminary way, and a somewhat increased degree of durability to washing is indicated.

The tensile strength of cotton fabrics treated with Hydro-Pruf is usually somewhat lower than that of the corresponding untreated fabric, and a part of this loss of strength may be accounted for by the high-temperature curing operation. The loss in strength varies considerably

* Trade-mark

depending on the construction and weight of the fabric, but in no case can it be regarded as excessive.

The abrasion resistance of cotton fabrics treated with Hydro-Pruf as determined by the Stoll Flex Tester, shows a marked improvement over the untreated fabric. When used with thermosetting resins, it provides improved abrasion resistance as compared with the resin treatment alone.

In conclusion, the work on Hydro-Pruf as a typical silicone water repellent shows that it is capable of producing satisfactory results in many applications to cotton fabrics. It has been used successfully with chintz finish on cottons as well as conventional types of finishes.

Research to Transform Cotton Through Chemistry Into New Textile Products

C. H. Fisher, *Book of Papers, 4th Canadian Textile Seminar*, p. 67-71, 1954.

The term "chemical transformation" is used here in its broadest meaning, ie, to include any treatment of cotton with chemicals that will effect permanent or near-permanent changes in properties and end-use potentialities.

Decrystallized Cotton. Some of the shortcomings of cotton fiber for certain end-uses are attributed to its large percentage of crystalline cellulose. High crystallinity implies a closely organized arrangement of the cellulose molecules, and is associated with such desirable properties as high strength and resistance to heat and moisture. However, high crystallinity is not advantageous where impact, strength, toughness and large extensibility before break are desired for industrial products, such as tire cord and conveyor and transmission belts.

The Southern Regional Research Laboratory has developed a treatment which markedly reduces crystalline cellulose without loss of natural fiber structure or the desirable physical properties already possessed by cotton. This crystallization treatment results in a cotton fiber which is tougher, more extensible, more absorbent, and which has a higher dyeing capacity and greater chemical reactivity than ordinary cotton. The higher reactivity should facilitate further modification of cotton by chemical treatments.

The crystallinity of cellulose is attributed to hydrogen bonding of the hydroxyl groups, three of which occur on each glucose unit. Of those chemical compounds investigated for their ability to break or loosen the hydrogen bonds, anhydrous liquid ethylamine was found to be the most useful. Without destroying or damaging the fiber, it reduces the crystalline cellulose from 80 to 90 percent in the native fiber to 25 to 35 percent in the treated fiber.

Improved Cotton Bandage. A new type of cotton gauze bandage of superior elasticity and clinging power, developed by the Southern Laboratory, was first reported in 1943-44. The new product is made by a special method for shrinking ordinary cotton gauze in strong caustic soda solution. This mercerizing treatment causes the fibers to swell and the yarns to crimp and kink. The resulting surface texture and elasticity of the gauze makes the bandage almost incapable of slipping.

Because of the chemical versatility of cellulose and the availability of numerous chemicals capable of reacting with cellulose, the opportunities afforded by the transformation of cotton into fibrous cellulose derivatives are almost without limit. The new fibers made in this manner are synthetic products having new chemical, physical and textile properties. In making such new fibers, esterification and etherification reagents have been used in most instances. Reagents that replace hydroxyl groups in cellulose with other groups also have been used.

Partially acetylated cotton, called PA cotton, may be used to illustrate the esterification method for transforming cotton into new fibers. Cotton can be converted into the acetate without loss of strength or of fibrous form through the application of a solution containing acetic anhydride and an acid catalyst in glacial acetic acid. While PA cotton has essentially the color, appearance, and the odorless and nontoxic properties of the original cotton, it has many new properties, including increased heat endurance and resistance to micro-organisms and certain types of chemical attack.

Aminized cotton, or AM cotton, is made by treatment with 2-aminoethylsulfuric acid and caustic soda. Its properties are quite different from those of untreated cotton; eg, AM cotton accepts most cotton dyes very rapidly, and some of these, especially direct dyes, give products that are more resistant to light and laundering than similar products from untreated cotton.

CM cotton is another new textile product made by etherifying cotton cellulose. Cotton, in the form of fiber, yarn or cloth is carboxymethylated by treatment with monochloroacetic acid, followed by treatment with strong caustic soda. Two different types of products can be made in this general manner. The first is a modified cloth having a built-in, starched effect, increased water absorbability and greater receptivity to crease-resistant treatments than ordinary cotton. The second is a water-soluble modified cotton that disintegrates upon contact with water or dilute alkali solutions. This product should be useful for scaffolding threads or wherever a thread is needed temporarily and subsequently removed.

Cyanoethylated cotton, or CN cotton, is made by treatment with acrylonitrile. It is resistant to heat degradation and micro-organisms, and the affinity for some dyes is improved.

PL cotton is made by treatment with propiolactone. The evaluation of this product is still in the experimental stage.

THPC cotton, made by treatment with $ClP(CH_2OH)_4$, in conjunction with methylolmelamine, possesses durable flame resistance and good resistance to rotting and wrinkling.

BA cotton is still another flame-resistant product, made by applying bromoalkyl allyl phosphate to cotton.

Synthetic rubber also has been used to impart permanent properties to cotton, eg, for the prevention of color transfer during laundering and crocking.—WHC.

X-Rays and Cotton Research

L. Segal and C. M. Conrad, *Textile Inds* 118, 116-20, December, 1954.

X-rays are routinely used today in certain industries as a production tool, and have found application by physicists and chemists in textile research.

Adoption of x-rays as an aid in producing better textile raw materials and for process and quality control in textile manufacturing is now in the foreseeable future, according to the authors.

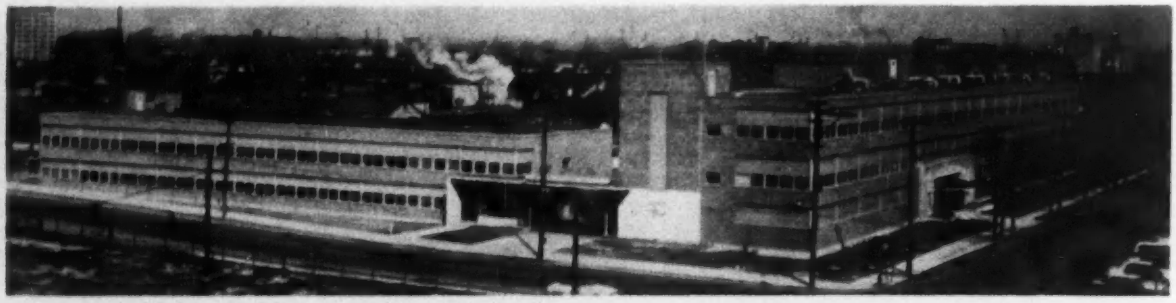
Plant breeding experts of the Department of Agriculture have found that x-ray examination provides a rapid and accurate means for determining differences in strength and other fiber qualities among experimental breeds of cotton, enabling breeders to choose new strains most likely to produce cottons of improved value to the mill.

X-ray examination quickly distinguishes the steps in the transformation of cellulose during the mercerization process, and the future role of the x-ray technique may include its acceptance as a standard method for controlling the process to small tolerances.

The use of x-rays is already common in fundamental studies of the cotton fiber, and the rayon industry recognizes and uses x-rays as an important implement in the evaluation of the products made under various spinning conditions.

The development of new types of chemically modified cotton fabrics has increased the need in the industry to investigate basic fiber structural changes. This need, together with the availability of the speedier, more simplified x-ray methods, should give greater importance to future use of x-rays in the cotton industry.—WHC.

News of the Trade



Aerial view of National Aniline Division's new multi-million-dollar Research-Engineering Center at Buffalo, N. Y. Center comprises two buildings, the Engineering Building (left) and Research Building (right).

• Open House Ceremonies Mark Opening of New Research-Engineering Center

The completion and occupancy of a new Research and Engineering Center at the Buffalo, N Y, plant of National Aniline Div, Allied Chemical & Dye Corp, was formally marked by Open House ceremonies last month commemorating National Aniline's 75th year. The events took place from May 19th through 21st, thereby coinciding with the observance of Chemical Progress Week, May 16-21, by the chemical industry of the United States.

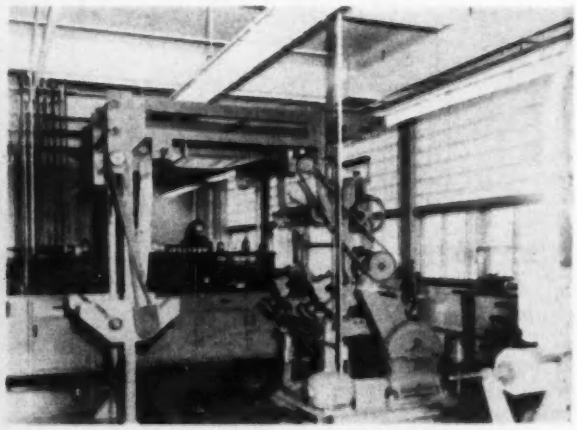
The program began with a preview and reception for representatives of press, radio and television in the Research Library on May 19th, and ended with a reception for all Buffalo plant employees and their families on May 21st. Donald G Rogers, president of National Aniline, headed a group of Allied and National officers and executives on hand for the affair.

Jean G Kern (right), manager of dye application research, examines a Wiesner-Rapp laboratory-size Barotor for pressure dyeing.

The Center, which will be occupied by 300 chemists, engineers and technologists, is a connected two-building facility, combining National Aniline's Research and Engineering Departments. Research is under the direction of Wesley Minnis, director of research and development, and engineering is headed by Forrest J Krueger, engineering manager. Direct supervision of the two facilities in Buffalo is under B M Helfaer, assistant director, research and development, and E H Bebee, assistant plant manager, engineering.

Embodying the latest design in scientific facilities, the Center is located at Elk and Peabody Streets, adjacent to National Aniline's 72-acre chemical manufacturing plant, which has grown from the small dye works founded on this location in 1879 by Jacob Schoellkopf, pioneer Buffalo industrialist. In 1920 this plant became part of Allied Chemical & Dye Corporation and has served as the principal manufacturing center of its National Ani-

Corner view———Dye Application Research Laboratory ———showing machines for experimental textile printing and processing.



Another view of the Dye Application Research Laboratory.

line Division, producing over 1800 different dyestuffs and associated intermediates and chemicals. In addition, National Aniline maintains an aniline and maleic anhydride manufacturing plant at Moundsville, W Va, where facilities for producing diisocyanates are now in course of construction, and a caprolactum monomer and spinning plant for producing Allied Chemical's Deep-Dye nylon at Hopewell, Va.

The Research Building is a three-story structure 337 feet long by 58 feet wide with a floor area of 36,500 square feet devoted to laboratories and 20,000 square feet for offices, a comprehensive library and service facilities. Totally, the Research Building contains 63,000 square feet and provides for initial occupancy of approximately 165 persons. A one-story wing 111 feet long is assigned to dye application research exclusively.

The building is of steel frame and brick wall construction with continuous windows of glass, glass block and stainless steel. There are nineteen typical laboratories in the building, approximately 32′ x 24′, exclusive of Dye Application Research. In addition, there are seven laboratories and special equipment rooms 18′ x 24′. Suitable chemical storage and supply rooms are provided. A machine shop is installed for research requirements. Group Leaders' offices are located adjacent to their laboratories. Separate rooms are provided for washing glassware. Ice machines are installed on each floor for research use.

Typical laboratories have two wall benches and three island benches, giving a total of 92 linear feet of bench space. At least two fume hoods are installed in each room and a separate exhaust fan is provided for each hood. Hood exhaust ducts are transite and will handle approximately 1200 cubic feet of air per minute. Copper piping is installed on benches and services provide water, steam, air, vacuum, gas and electric. Distilled water is run to certain benches. Average occupancy of the typical laboratories is six men.

Eight symbols in the frieze decorating the lobby of the Research Building represent the graphic formulas for chemical compounds common to National Aniline's operations. Depicting raw materials, organic chemical compounds, dye intermediates and colors used and manufactured at the Buffalo plant, they are: Crystal Violet, Indigo, Aniline, Benzene, Naphthalene, Phthalic Anhydride, Beta-Amino Anthraquinone, and Carbanthrene Blue RS.

The Engineering Building, two stories in height, corresponds architecturally to the Research Building so that the two buildings together comprise a Center and a unit group for technological service. The Engineering Building is 208 feet long and 58 feet wide, with a total floor area of 23,000 square feet providing for initial occupancy by approximately 135 persons.

This building also provides office facilities for engineering and for plant maintenance, construction and power supervision. The plant purchasing service is located on the first floor. Offices are provided also for the planning and statistical group and for the public relations director of the Buffalo plant.

The twelve symbols in the frieze decorating the lobby of the Engineering Building represent devices developed by and used in the practice of engineering technology.

• Delta Finishing Adds to Wallace Plant

A 52,000 square foot addition to the dyeing and finishing plant in Wallace, South Carolina for Delta Finishing Division of J P Stevens and Co, Inc, has been completed by Daniel Construction Company, Greenville, S C.

The one-story totally-enclosed plant addition, reported to cost $186,000, will be used to finish and store cotton goods for J P Stevens plants elsewhere in the country. No space has been allocated for offices, which are presently located in the original plant. Delta Finishing Division's original plant in Wallace was completed in March 1952. A warehouse addition to the plant was completed in April, 1953.

• Clinton Foods Occupies New Greenville Quarters

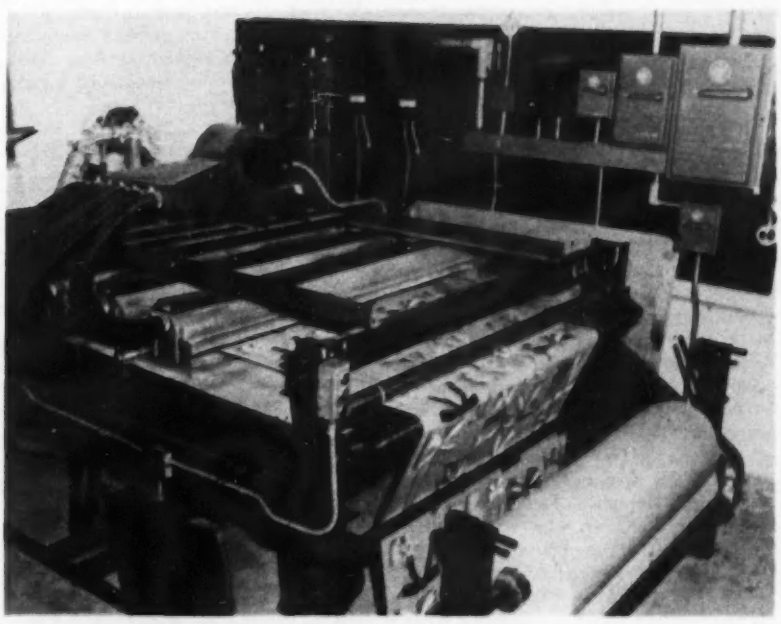
Clinton Foods Inc, Clinton, Iowa, last week moved into its new laboratory and office building at 520 E North Street, Greenville, S C. The new combination laboratory and office building is part of Clinton Foods' extensive expansion program for 1955. Until now, the Clinton sales office has been at Suite 900 in the South Carolina National Bank Building in Greenville.

R C Rau, southeastern division manager of Clinton Foods Inc, stated that C F Cline, Jr has been appointed district sales manager of the territory to be served through the new office which includes North Carolina, South Carolina and eastern Tennessee. Working with him will be Frank Rogers at Greenville and Grady Gilbert, who will remain at Concord, N C.

The new laboratory facilities will be under the direction of Edgar F Patterson, assisted by Robert A Conzett.

• New Hang Tag Identifies Ranedare-S

Metro-Atlantic, Inc, Centredale, R I, has introduced a new hang tag to identify its Ranedare-S durable silicone water repellent, which is formulated from General Electric Wonder Silicone Dri-Film. The tag is now available to converters, garment manufacturers and retailers.



CURING PIGMENT COLORS. Stonehenge Processing Corporation, Cedar Grove, New Jersey, employs this simple device to cure its pigment colors. The Electro-Ceramic curing equipment is built by Sill Industries, Maplewood, N J. Six units are sufficient to cure pigment colors on all fabrics at required rates of speed, it is reported. Speed of the curing operation varies with fabric weight.

The "big bay" at Stowe-Woodward's new Griffin, Georgia, plant.

• Stowe-Woodward Dedicates Griffin Plant

The latest techniques in the art of rubber roll compounding and covering were on display for textile manufacturers and papermakers on May 4th. The City of Griffin, Ga, was the scene; and the occasion was the formal opening and dedication of Stowe-Woodward's newest rubber roll plant.

Put into production early this year, and now in full-scale operation, this new Griffin plant marks the second major expansion on the part of Stowe-Woodward within a year. A similar Open House and Dedication was held last June at the opening of Stowe-Woodward's Neenah, Wis, plant.

The plant building itself was specifically designed to meet the unusual production flow and work area requirements of rubber roll manufacture.

More than 500 guests, altogether, attended. The morning session was limited to paper and textile men, business friends of Stowe-Woodward and its executives.

Following the plant tour, a Southern barbecue was served on the plant grounds. At the barbecue, the group was addressed briefly by E W Peterson, president of Stowe-Woodward; Paul Mitchell, manager of the Griffin Plant; H L Cochran, president of the Griffin Chamber of Commerce; W E George, city manager of Griffin; and Herman E Talmadge, former governor of Georgia, who was in office when plans for the Stowe-Woodward Griffin plant were initiated.

In the afternoon, the plant was open to families of all Stowe-Woodward employees and their friends, together with a large number of Stowe-Woodward's new Griffin neighbors.

• Holds Dyeing of Match-Mates Simplified with Acrilan

The danger of match-mates not matching under artificial light is eliminated when Acrilan is one of the fibers, W H Hindle, associate director of research in charge of dyeing and finishing for The Chemstrand Corporation, told the May conference of the Knitted Outerwear Manufacturers Association, Pennsylvania District.

Mr Hindle said that, because Acrilan acrylic fiber can be dyed with wool-type dyestuffs, the dyeing of match-mates where accurate match in all light sources is important, is much simpler than with many other fibers. He added that, in many cases, it is possible to use precisely the same dyestuffs on both Acrilan and the other fiber involved, thus eliminating shade changes in varying lights.

Mr Hindle also told the Knitted Outerwear group that crush and crack marks, often associated with acrylic fibers in jersey cloths can be eliminated by a combination of dyeing and finishing techniques.

"Crush and crack marks are caused in the dyeing operation by the need for high temperature dyeing while in rope form," he said.

"If after dyeing, the dyebath is allowed to cool by radiation to 130°F and at the rate of 2°F per min until 105°F is reached, any residual crack marks can be readily removed in the recommended finishing operation."

"After the slow cooling and finish application steps, the goods are lightly extracted. They are then subjected to a steaming process at maximum width while still in a damp state. It is extremely important that the steam be sufficient temperature to substantially raise the over-all temperature of the fabric. The fabric is then passed through two rubber rollers."

"The purpose of the steaming," Mr Hindle said, "is to raise the temperature of the fabric to the point where the rubber rolls of the pad perform an ironing or wrinkle-removing operation. After this step the goods are dried and finished conventionally."

Mr Hindle also emphasized the extremely flexible nature of Acrilan dyeing because of its ability to accept a number of different dyestuff classifications.

He said that dyers who are judicious in color selection in the handling of a typical color range are utilizing

1) Basic dyestuffs in light, bright pastel shades.
2) Disperse (acetate) dyestuffs in up to dark medium shades.
3) Metalized dyestuffs for dark shades.

Of particular interest, Mr Hindle said, is the development whereby disperse acetate and basic dyestuff can be mixed to give heavy bright shades. He pointed out that, in the field of blends, the ability of Acrilan to union dye with Vicara, nylon, wool, rayon and acetate in a single bath operation offers the dyer maximum advantage from a color, cost, and time standpoint.

• Harshaw Moves New York Office

On May 20 the New York Branch Office of The Harshaw Chemical Company was moved to Hastings-on-Hudson, N Y, at the plant site of the company's recently acquired subsidiary, Zinsser Co Inc, manufacturers of dyestuffs, organic dry colors and fine chemicals.

Direct New York telephone lines to Hastings-on-Hudson are available for use by Metropolitan New York customers.

Warehouse stocks of Harshaw materials for delivery to customers in and around New York continue to be carried at the Grayfleet warehouse in Brooklyn.

• LTI Dean Addresses NY Alumni

The New York Chapter of the Lowell Technological Institute Alumni Association met for its regular biannual meeting on June 2nd at Morgen's Restaurant, New York, with 50 members in attendance.

Guest speakers of the evening were Charles F Edlund, dean of faculty at LTI, who discussed "LTI in 1980", and Elmer E Fickett, chairman of the LTI Alumni Endowment Fund.

Chairman Lathrope A Schiffer, Deering Milliken & Co, Inc, named the following Nominating Committee to select a slate of officers for election by mail ballot: Irwin Smoler, Smoler Bros Inc; James Pottinger, Reliance Mfg Co; and Charles A Whitehead, *American Dyestuff Reporter*.

• Versenes Absorbed by Dow

Versenes Incorporated, Framingham, Mass, purchased in November, 1954, by The Dow Chemical Company and operated since then as a subsidiary, has been absorbed by the parent company.

Manufacture of the series of chelating agents sold under the trade names Versene and Versenol will continue at the Framingham plant but the sales and development functions are being transferred to Dow's headquarters in Midland, Mich.

According to Leland I Doan, Dow president, certain advantages will accrue from the transfer, including improved customer service resulting from the Company's widespread sales service organization and product distribution system served by a teletype network which connects sales offices, plant facilities and terminals located throughout the country and Canada.

Simultaneously with the transfer, the Company announced a price revision which results for the most part in lower prices to many customers, especially those requiring chelating compounds in carloads or mixed carloads. At the same time, price increases went into effect on single drum lots of certain products.

Versenes Incorporated became a subsidiary after Dow purchased all stock and assets of the Massachusetts firm. The subsidiary status was dissolved May 31.

• New Executive Offices for Witco

New executive offices of Witco Chemical Co have been opened in the Chanin building, 122 East 42nd Street, New York. Occurring on the company's 35th anniversary, the move reflects Witco's rapid growth by the acquirement of space more than twice as large as previously occupied.

To celebrate the anniversary, and permit inspection of the new headquarters, Witco held a reception last month for customers, suppliers, the press and other friends.

Since 1953, Witco has expanded its manufacturing, research, and sales facilities. New plants have been opened in California, Oklahoma and England, and production facilities have been enlarged at several of the company's other plants.

During the current year, Witco's Rubber Chemicals Division was created, and chemical manufacturing facilities of the Emulsol Corporation were purchased. In addition, Witco acquired a half interest in Ultra Chemical Works Inc, which operates plants in Paterson, N J, Joliet, Ill, and Hawthorne, Calif.

Presently, Witco owns and operates 15 plants and four laboratories in the United States and England. In addition, nine sales offices are maintained in seven different states, as well as two in England.

Shown discussing the agenda of a conference on cotton fiber research, recently held in New Orleans, Louisiana, at the Southern Regional Research Laboratory of the USDA Agricultural Research Service, are: C M Conrad, Head of the Southern Laboratory's Cotton Fiber Section; Charles W Hock, Hercules Powder Company; E I Valko, Onyx Oil and Chemical Company; Turner Alfrey, Jr, Dow Chemical Company; and Leonard Smith and George Buck, National Cotton Council.

Once a year a committee of specialists from industry and other research organizations reviews the research program of the Cotton Fiber Section. These conferences provide an opportunity for exchange of ideas and for discussion of research approaches that would help to improve and strengthen cotton's competitive position in different end uses.

• AIEE Textile Subcommittee to Sponsor Conference on June 30

The Textile Subcommittee of the American Institute of Electrical Engineers on June 30th will hold a conference on the proposed recommended electrical practices for installations and use of electricity and electrical devices on textile machinery.

The conference, to be held at the Ocean House, Swampscott, Mass, will be concerned principally with making these recommendations available to principal textile machinery manufacturers and textile mill personnel.

The following topics will be covered: Purpose and Scope of Recommended Practices, Control Circuits, Control Equipment, Enclosures, Wiring Methods and Practices, Conduit-raceways and Junction Boxes, Electrical Accessories, and Class 2, Low Voltage Limited Energy Circuits.

• Cyanamid Consolidates Cincinnati Facilities

Five divisions of American Cyanamid Co now occupy a new building at 2350 Glendale-Milford Rd, Evandale, O, a suburb of Cincinnati, following a recent consolidation of all office and warehouse facilities in that area.

The ultra-modern building of buff brick and Bedford stone has 30,000 square feet of office and warehouse space.

The five divisions, which employ about 50 persons in the area, are: Fine Chemicals, Lederle Laboratories, Industrial Chemicals, Pigments, and Plastics and Resins.

• Foxboro Establishes Ten Regional Sales Divisions

Intensifying its instrument sales engineering coverage, The Foxboro Company, Foxboro, Mass, has established ten regional sales divisions. Administered by H O Ehrisman, newly appointed general sales manager, and J J Burnett, field sales manager, the new regional structure will permit full utilization of the company's 48 branch offices.

Geographically, the new sales regions are integrated with Foxboro's newly expanded service and manufacturing facilities, new branch factories having been constructed in Dallas, Pittsburgh and San Leandro, Calif, during the past year.

The ten regional sales offices and regional managers are: *New England*—H H Michelmore; *New York*—E R Huckman; *Philadelphia*—J B Deaderick; *Pittsburgh*—A H Shafer; *Atlanta*—E W Prendergast; *Cleveland*—H L Lee; *Chicago*—J J Connelly; *Dallas*—E L Stark; *Houston*—L W Parten; and *San Francisco*—R E Rogers.

Internationally, Foxboro maintains direct representation throughout the world and associated companies in Montreal, London and Mexico City.

• New ΔΚΦ Chapter Organized

A newly formed chapter of Delta Kappa Phi, national textile fraternity, met for the first time on May 25th at the Woodstock Hotel, New York. Numbering approximately 70 members in the metropolitan New York area, the new chapter plans to hold monthly meetings in the future.

In the presidential office of J C Warner, head of Carnegie Institute of Technology, Aiken Fisher, president of Fisher Scientific Co, holds watch while waiting to give signal to Dr Warner to open Fisher plant in Fair Lawn.

• Fisher's New Reagent Plant in Production

Production lines started rolling on May 17th in the new manufacturing laboratories of Fisher Scientific Company's $1,200,000 reagent-chemical plant, located on a 9-acre site in Fair Lawn Industrial Park, Fair Lawn, N J.

The new plant is believed to be the first in America designed exclusively for reagent chemicals, which are made in small lots of a few hundred pounds, receiving up to 14 laboratory tests each.

In dedication ceremonies last month, J C Warner, president of Carnegie Tech and president-elect of the American Chemical Society, poured some Fisher sodium hydroxide reagent into a beaker of acid on a titrimeter, the action of the base and the acid closing the instrument's "magic eye" and thereby setting off the telephone signal for the start of production at Fair Lawn.

Outstanding features of the new plant include five laboratories, all-electronic packaging equipment for packaging the entire line in volume units, a comprehensive technical library, a modern manufacturing building, "air-scrubbing" towers, and the 1/5-mile-long loading platform.

• Laurel Soap Introduces New House Organ

Laurel Soap Manufacturing Company, Inc, has begun publication of *The Laurel Leaf*, an external house organ with articles of interest to all segments of the textile industry. It is currently being published on an every-other-month basis.

Copies of the *Laurel Leaf* may be obtained by writing direct to Laurel Soap Manufacturing Company, Inc, Tioga & Almond Sts, Philadelphia 24, Pa, or through *American Dyestuff Reporter*.

• Onyx Announces Price Reduction

Onyx & Chemical Co, Jersey City, N J, has announced an 18 percent reduction in the price of Xyno-Resin X-99, from 31 to 26 cents per lb in barrel lots, fob, Jersey City.

X-99 is said to impart an excellent parchment finish to the newer synthetics when used with Resin G-36, and to give superior "bounce" when used with wax or nonsiliconic curable-type water repellants, without impairing spray ratings. It is also a hand-builder and slipproofing agent.

To obtain a springy hand with added weight on spun viscose and spun viscose blends, Onyx recommends the use of from 1 percent to 5 percent of Resin X-99 in conjunction with Resin SS as a noncuring resin finish.

• U S Testing Moves Philadelphia Branch

Expansion of its Philadelphia branch laboratory has been undertaken by United States Testing Company, Hoboken, N J. This move to new and larger quarters at 3925 M Street, Philadelphia 24, Pa, is said to triple the company's chemical laboratory facilities with which to conduct tests on soaps, fats and oils, textiles and textile chemicals, etc.

Of special interest at the branch opening last month was a display of instruments designed and manufactured by the company. Among instruments demonstrated were the new Carson-Worthington Universal Stiffness Tester, the Terg-O-Tometer for evaluating detergents and cleaners, and the new Model C Twist Tester for yarns.

The Philadelphia branch is one of ten laboratories maintained by the Testing Company throughout the nation.

• Suffolk Associates Established

Suffolk Associates, a new firm located at 10 East 40th St, New York 16, N Y, is now functioning under the management of C P Thuot, who for 8 years directed Parsons & Whittemore's Chemical and Industrial Sales Division.

The new firm's primary activity will be to export chemicals, raw materials and equipment to the textile, paper, publishing, and printing-lithographing industries. Among other things, it will market the "Suffolk" brand of inks, dyes, chemicals and waxes-resins.

Suffolk will also maintain another section to import consumer goods and raw materials from German, Swedish, Swiss & English origins. This department will function as resident buying agent for firms here and abroad.

• Baird to Represent Japanese Manufacturer of Thiourea Here

Baird Chemical Corporation, New York, has been named United States sales agent for the sale of thiourea manufactured by Miike Synthetic Industry Co, Ltd, Ohmuta, Japan.

To encourage wider use of Miike Thiourea, which is said to have extremely low iron and sulfur contents, Baird has reduced prices to $0.37 per lb fob New York for truckload quantities and $0.38 per lb for less-than-truckload orders.

Samples and specifications of Miike Thiourea are available from Baird Chemical Corporation, 254 West 31st Street, New York 1, N Y.

• Key Chemicals Moves Main Office

In an effort to consolidate its activities, Key Chemicals Corporation has moved its main office from Washington D C, to its plant location at Medley (Miami Springs), Fla.

Key Chemicals is a producer of textile resins, polyesters, alkyd resins, chemically resistant drum linings, emulsion polymers, vinyl plasticizers, emulsifying agents, etc.

• New Sarco Sales Agents

J B Lammons Co, 1596 Madison Ave, Memphis, Tenn, and Robert Porter, 224 N Congress St, Jackson 2, Miss, have been named sales representatives for Sarco Co, Inc, manufacturers of steam traps, temperature regulators, heating specialties and Sarcotherm weather-compensated control systems.

Sarco maintains sales offices in the Empire State Bldg, New York, and a factory in Bethlehem, Pa.

• Hooker 50th Anniversary

Hooker Electrochemical Co, with plants at Niagara Falls, N Y, Tacoma, Wash, and Montague, Mich, marked its fiftieth anniversary last month.

On May 5, 1905, ground was broken in an orchard on a farm at the company's present headquarters plant site on Buffalo Avenue, Niagara Falls, N Y, and the following January, operation of the company's original plant was begun. Successful operation prompted expansions in 1908 and 1909 which quadrupled the plant's capacity.

Hooker Electrochemical Co, organized in 1909, is the outgrowth of Development and Funding Co, founded in 1903 by Elon Huntington Hooker. Theodore Roosevelt, then governor of New York, appointed his intimate friend, Elon Hooker, to supervise construction of the Barge Canal which Hooker Electrochemical currently uses to transport liquid caustic soda to the Atlantic Seaboard.

In May, 1910, the Hooker plant was swept by the "Great Fire" which demolished almost 60% of the buildings. Within five months the company placed an even larger plant in operation.

Diversification from the company's two original products, caustic soda and chlorine, began in 1915 when liquid bleach production was started and a plant to produce monochlorobenzene went into operation. The production of monochlorobenzene marked Hooker's entry into the field of chlorination of organic compounds.

It was in 1916 that R Lindley Murray, now president; Bjarne Klaussen, executive vice president; Jesse H Babcock, vice president; and Frank W Dennis, vice president in charge of industrial relations, joined the Hooker organization.

During World War I, Hooker manufactured monochlorobenzene for the French Government and later it produced picric acid for both the French and United States Governments for use in explosives. To fulfill these government contracts, Hooker built their renowned monochlorobenzene plant from which it also sold products to the domestic dyestuff industry. Additional markets later were found for by-products of this plant.

Chlorination of toluol has been responsible for many of the Company's fine chemicals, such as chlorotoluol, sodium benzoate and benzoic acid, which were first commercially produced by Hooker in 1917. A year later, Hooker first produced sulfur chloride commercially. This was followed by chlorination of metals, such as aluminum, antimony and iron, in the 1918-20 period.

The twenties witnessed electrochemical and engineering development of the electrolytic cell which produces chlorine and caustic soda and improving efficiency of the company's operations. In 1929 the Hooker Type "S" cell was developed, with increased capacity. Since then giant "S-3" and "S-3A" cells, larger modified versions of the Type "S" cell have been developed. Over 40% of the chlorine produced in the country today, including Hooker's licensees, reportedly comes from Hooker Type "S" cell was developed, fications thereof.

Hooker's second caustic-chlorine plant at Tacoma, Washington was opened on February 4, 1929.

During 1952 and 1953 a $25,000,000 expansion program, greatest in Hooker's history, was undertaken. This program was featured by a new $15,000,000 caustic soda-chlorine plant at Montague, Michigan, which started production in March, 1954.

Hooker now produces about 100 different chemicals, all using chlorine, caustic or hydrogen in their manufacture, and supplies over 30 industries. Employing almost 2,500 persons, Hooker's sales now run about $45,000,000 per year. With expanded facilities, and with a research budget of over $1,000,000 for 1955, Hooker looks forward to its development in the years ahead.

The consolidation on April 27, 1955 of Durez Plastics & Chemicals Inc., North Tonawanda, N Y, into Hooker marks a major milestone in the company's growth and plans for diversification. This action gives Hooker a much stronger and more diversified position in the very rapidly-growing plastics field.

• Oakite Establishes New Export Division

Oakite Products, Inc, New York manufacturers of specialized industrial cleaning and related materials, has announced the formation of an Export Division to handle the increasing demand from Latin American and overseas companies. Harry V Kerker, with Oakite since 1943, has been appointed manager of the new division.

In announcing the formation of the new division, John A Carter, president of Oakite, cited the growth of the company since 1909. It now manufactures more than 115 different materials, has more than 225 representatives, and serves more than 35,000 customers in the United States and Canada.

Booklets describing Oakite's operations in each industrial field are available from the Export Division, Oakite Products, Inc, 154A Rector St, New York 6, N Y.

• UCC to Sell Dynel on FOB Price Basis

Dynel staple and tow now being shipped on an fob basis, according to A L Snyder, sales manager, Textile Fibers Department of Carbide & Carbon Chemicals Co, a division of Union Carbide & Carbon Corp. Heretofore, the fiber has been sold on a delivered basis.

Title now passes to the buyer on delivery to the common carrier at South Charleston, W Va. Prices are the same as previously: natural $1.28, whitened $1.35, and spun with color $1.50.

Shown above is the new laboratory annex building which is adjacent to the present main inland proving ground and existing laboratory and office buildings of South Florida Test Service, Miami, Fla. This new building adds 300 square feet of working space.

In connection with the building SFTS is putting in an auxiliary test field consisting of 75,000 square feet, making a total of approximately 180,000 square feet being utilized for inland direct weathering and under-glass exposure tests on textiles, plastics, leather, paper, etc. SFTS also has locations directly on the ocean for salt atmospheric exposures and alternate and total sea water immersion tests.

South Florida Test Service will celebrate its 25th anniversary next year, at which time a formal opening of the new facilities will be held.

• Hercules' Burlington Plant Addition Begins Operations

The beginning of operations of a new $4,000,000 addition to Hercules Powder Company's Burlington, N J, plant was announced on May 26th. The new facilities will be used to manufacture DMT (dimethyl terephthalate), basic chemical for the manufacture of Terylene.

Representatives of Imperial Chemical Industries Ltd, and Canadian Industries (1954) Ltd, and top executives of Hercules were present for a tour of inspection of the new facilities. The group included: A E Forster, president, Hercules Powder Company; A Caress, chairman of the Terylene Council, Imperial Chemical Industries Ltd; Roland Winsor, general manager, Fibers Department, Canadian Industries (1954) Ltd; Wyly M Billing, general manager; and Paul L Johnstone, director of development, Hercules' Synthetics Department.

The new Burlington plant addition reportedly will supply one million pounds of DMT a month to a new $22,000,000 plant at Millhaven, Ontario, of CIL. This plant, which has recently gone on stream, will make about 11 million pounds of Terylene annually. During the past year, Hercules has been producing DMT on a semicommercial scale pending completion of the new unit. The new Hercules plant which also supplies licensees of ICI is said to be the first to manufacture dimethyl terephthalate using a new air-oxidation process.

Hercules officials have stated that research and market development programs have already produced several interesting nonfiber uses for DMT.

This is the second important new industrial field to be entered by Hercules within the past six months. The company recently opened a new multimillion dollar plant at Gibbstown, N J, which produces phenol, acetone, and other related chemicals by the Hercules cumene oxidation process.

Floyd W Green (left), newly installed chairman of the Eastern New York Section, ACS, is presented with gavel by outgoing chairman Alexander Surrey during annual meeting of the Section last month at Glens Falls, N Y.

• IPCC Host to ACS Section

More than 200 members of the Eastern New York Section of the American Chemical Society, accompanied by their wives, attended the annual meeting of the Section on May 21st at Glens Falls, N Y, with Imperial Paper and Color Corporation serving as host for the day.

Floyd W Green of Imperial's research staff was installed as chairman of the Section, thus becoming the first Section officer to be elected from the Glens Falls area. He succeeds Alexander Surrey, Sterling Winthrop Research Institute, to the post. Dr Green became a member of ACS in 1942, the year in which he joined Imperial.

As hosts, Imperial provided a conducted tour of the plant and laboratories of their Pigment Color Division. Seventy-five members were shown the many sections of the plant where chrome yellows, chrome greens, molybdate oranges, zinc yellows, phthalocyanine blues, chromium oxide, chromium hydrate and cadmium colors, as well as many organic colors, including reds, yellows, greens and blues are manufactured. The members also visited the raw material production units where sodium bichromate, lead chemicals, organic intermediates and various other raw materials are manufactured. Later, the visitors were shown Imperial's extensive research and quality control laboratories, which are staffed by more than 50 graduate chemists and chemical engineers. Of considerable interest to the group was a demonstration of the spin dyeing of synthetic fibers using pigment-color dispersions.

Members' wives were entertained during the afternoon at the Glens Falls Country Club, receiving a talk on home decoration by Jean McLain of Imperial's Wallpaper Division. The day's activities were concluded with a dinner for the membership at the Club.

J H Holloman, manager of the Metallurgy Research Dept of the General Electric Co, was the speaker at the dinner. Recently chosen by the Junior Chamber of Commerce as one of the ten most outstanding young men in the nation for 1954, Dr Holloman is also the recipient of a long list of other awards. His talk, titled "Man, Metals and Mars", traced the origin of metals and man's use of them from the earliest tools and weapons to the present applications of special alloys in jet and rocket engines.

GENERAL CALENDAR OF COMING EVENTS

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

National Convention—Sept 26-28, Lake Placid, N Y.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Meeting of the Textile Subcommittee—June 30, Ocean House, Swampscott, Mass.

AMERICAN SOCIETY FOR TESTING MATERIALS

58th Annual Meeting—June 26-July 1, Chalfonte-Haddon Hall, Atlantic City, N J.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Meeting of the Textile Engineering Division—June 23, Hotel Statler, Boston, Mass.

DRYSALTERS CLUB OF NEW ENGLAND

June 24 (Outing—Wachusett Country Club, W Boylston, Mass).

GARMENT DYERS GUILD OF AMERICA

Sept 9-10, Loebl Dye Works, Roanoke, Va.

THE FIBER SOCIETY

Fall Meeting—Sept 8-9, Massachusetts Institute of Technology Cambridge, Mass; Spring Meeting—May 2-3, The Clemson House, Clemson, S C.

INTERNATIONAL TEXTILE EXHIBITION

2nd Exhibition—June 25-July 10, 1955, Brussels, Belgium.

INTERNATIONAL WOOL TEXTILE RESEARCH CONFERENCE

September, 1955—Sydney, Melbourne, and Geelong, Australia.

NATIONAL COTTON COUNCIL OF AMERICA

1955 Chemical Finishing Conference—Sept 20-21, Chalfonte-Haddon Hall, Atlantic City, N J; 7th Annual Cotton Research Clinic—Feb 15-17, Pinehurst, N C.

NATIONAL INSTITUTE OF DRYCLEANING ALUMNI SOCIETY

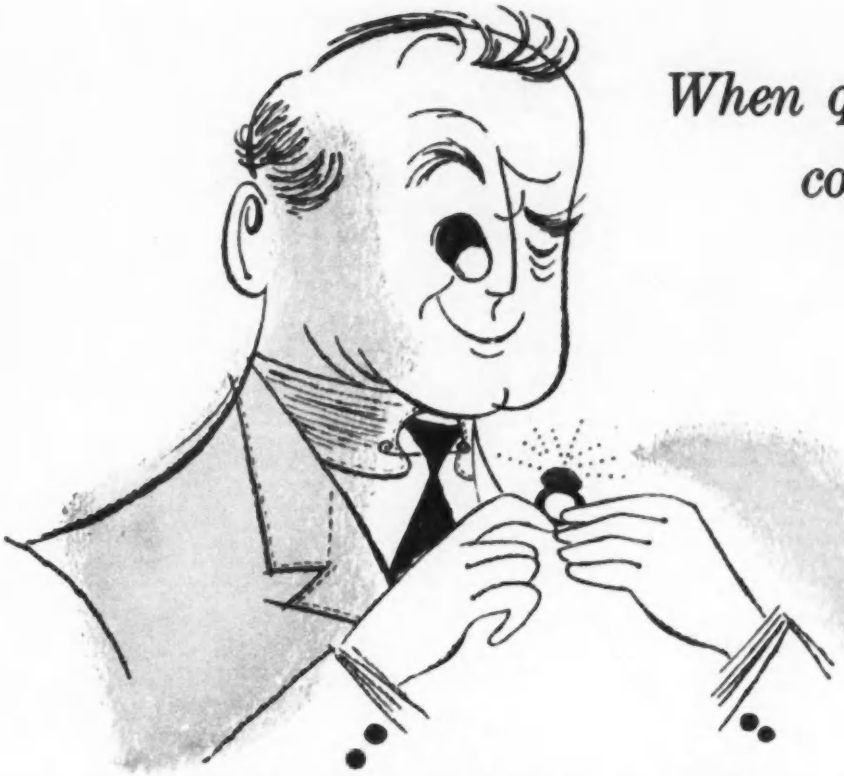
Annual Reunion—August 12-14, NID and Shoreham Hotel, Washington, D C.

PHI PSI FRATERNITY

Annual Meeting—April 19-21, Alabama Polytechnic Institute, Auburn, Ala.

SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION

Sept 14, Oct 11, Nov 9 (Hotel Commodore, New York, N Y).



When quality counts . . .

it pays to go to a specialist

WHEN QUALITY DYE PERFORMANCE COUNTS, IT PAYS TO GO TO

ALTHOUSE

Leading Specialists in Dyes for Cotton — Rayon — Nylon and Other Synthetics and **blends**

For 40 years Althouse research has pioneered in raising textile industry standards of

COLORFASTNESS

This record of leadership assures highest quality performance when you specify these famous, exclusive Althouse dye specialties:

Superlitefasts	Nylanthrenes
Azoanthrenes	Nydyes
Supernylites	Sol-Aqua-Fast

ALTHOUSE

PENETRANTS • DETERGENTS • SOFTENERS • REPELLENTS • FINISHES

BURK-SCHIER

BURKART-SCHIER CHEMICAL CO., CHATTANOOGA, TENN.

CLASSIFIED ADVERTISEMENTS

Advertisements in this section are restricted to HELP WANTED—POSITIONS WANTED—EQUIPMENT wanted or for sale. Rates, effective February 1, 1954: One-time, $10.00 per column inch; 3 consecutive times (same copy), $9.00 per column inch; 13 or more times, $8.00 per column inch; Position Wanted, $2.00 per column inch. Figure 38 average words per column inch. Publisher reserves the right to reject or discontinue any classified advertisement. Replies should be addressed: Box Number . . ., c/o American Dyestuff Reporter, 44 East 23rd Street, New York 10, N. Y.

ABSTRACTING SERVICE—Abstracting and digesting of foreign patents and periodicals. Literature review and special reports in dyestuff and cellulose chemistry. PAUL WENGRAF, 88-36 ELMHURST AVENUE, ELMHURST 73, NEW YORK.

POSITION WANTED: Dyer-Chemist, desires position with dyestuff, chemical or fiber firm. Extensive plant, laboratory, and managerial experience in box and jig synthetic plants. Textile college graduate. Write Box No. 897.

POSITION WANTED: JIG DYER, 25 years' experience, directs, acetates, nylon and blends. South preferred. Write Box No. 884.

PLANT CHEMIST OR DYER'S POSITION WANTED: By chemist, college graduate. Over 20 years' experience in dyeing and finishing of cotton synthetics and wool fabrics. Have worked as dyer, finisher, laboratory director and superintendent. Will consider offer anywhere. Write Box No. 900.

POSITION WANTED: Machine and screen printing. 24 years' experience. Experienced all classes of dyestuff on cotton, wool and synthetics. Fully capable of taking charge of print or color-shop department, supervisor or superintendent. College graduate. Will consider offer abroad. Write Box No. 901.

WANTED: Chemical director wanted for manufacturer, located in New York metropolitan area, of textile and leather chemical specialties such as resins, surfactants, sequestering agents, etc. Excellent opportunity for the right man. Write Box No. 915.

WANTED: PHYSICIST or PHYSICAL CHEMIST, 3 to 5 years' experience in colorimetry and spectrometry. To develop methods and direct spectrophotometric analyses of dyestuffs, pigments and textile materials and to interpret results for use in solution of research problems.

CHEMIST, PhD in organic chemistry or MS with 1 to 2 years' research experience, preferably in polymers. For research related to the synthesis and application of chemical compounds connected with durable finishes for synthetic fabrics.

RESEARCH CHEMIST, PhD, for research in organic chemistry involving the study of color fastness of dyed fabrics and the development of new dyeing processes.

The continuing growth of the Celanese Corporation in the textile, chemical and plastics industries creates openings for qualified men in the Research Laboratory located in Summit, New Jersey, a pleasant residential community within 30 miles of New York City. These positions are permanent, and provide excellent opportunity for personal growth and advancement.

Please write complete details, including salary requirements, to—Mr. J. A. Berg, CELANESE Corp. of America, Morris Court, Summit, N. J.

OPPORTUNITY for sales minded technician. Well established, well financed chemical specialty manufacturer has opening in South Carolina-Georgia area. Prefer resident who can develop a territory. Write Box No. 910.

POSITION WANTED: Production Manager, Colorist, Supervisor, in textile screen printing or allied fields. Customer liaison and business experience. Cost conscious. Will relocate. Write Box No. 876.

CLASSIFIED ADVERTISEMENTS

DEVELOPMENT CHEMIST — Progressive and expanding company requires graduate chemist with 3-5 years' of plant experience in printing and finishing. Present opening is for a man who is capable of working with a minimum of supervision on the development and evaluation of textile specialties for sizing, printing and finishing of cotton and synthetic fibers. Laboratory located in Charlotte, North Carolina. Give details of experience and salary requirements. Write Box No. 919.

POSITION WANTED: Sales development and demonstration textile chemist. Dyeing and finishing. 20 years' solid experience, practical research and supervision with top manufacturers, in circular knit, natural and synthetic piece goods, narrow fabrics, synthetic yarns for carpet, drapery and upholstery trades. L.T.I. graduate, B.T.C. degree. Write Box No. 911.

POSITION WANTED: Textile chemist and supervisor, with thorough background and practical experience, both in laboratory and supervision of dyeing and finishing of natural and synthetic fabrics. Graduate of Lowell Textile Institute. Familiar with processing of all types of fabrics, and use of all types of dyestuffs. Write Box No. 912.

WANTED: Long established N. Y. dyehouse is seeking the following experienced men: (a) Dyer on worsted yarns and piece goods (b) Dyer on synthetic knitted cloth —and sweaters (c) Textile colorists to work in laboratory. In reply state qualifications, age, education and salary expected. Write Box No. 913.

POSITION WANTED: Textile Colorist and Chemist. Twelve years' experience Sales-Service laboratory level. Standardizing, shade matching, trouble shooting. College graduate. Interested in laboratory position on supervisory level or will consider sales. Write Box No. 921.

POSITION WANTED: Dyer, with technical background and 18 years' practical mill experience. Will relocate. Write Box No. 922.

WANTED: Dyehouse superintendent, between the ages 30 and 45, to manage and administer the operation of a large cotton dyehouse. Though the position is largely administrative, because of the size of the operation, the man must be thoroughly familiar with and have had experience in the dyeing of vats, naphthols, sulphurs, indigosols, directs and diazos on cotton piece goods, on ranges, padders and jigs. Excellent opportunity for advancement in a large progressive organization. Many company benefits. Five figure salary commensurate with ability for the right man. Write Box No. 923.

DYE SALESMEN WANTED: Leading dye concern has openings for one or two experienced and able salesmen with a good technical background especially in the vat dye field. A fine future is available to outstanding men. Send full particulars in own handwriting. Write Box No. 924.

SALESMAN WANTED: To handle well established line of chemical specialties for textile mills, especially dye house products. For North and South Carolina territory. Give full information. Replies held confidential. Write Box No. 925.

POSITION WANTED: Textile college graduate. Chemist. Diversified experience dyeing, finishing, auxiliaries manufacturing. Good administrative background. Age 33. Seeks responsible position plant or technical sales. Presently assistant superintendent dyehouse; plant chemist. Write Box No. 926.

WANTED: Colorist, for screen print plant located in Georgia, perferably man who has experience with printing all classes of dyestuffs and pigments on synthetic and natural fibers. Reply in detail including experience, personal history and salary desired. Write Box No. 927.

POSITION WANTED: CHEMIST, 41. Seven years' detergents, textile auxiliaries. Two years' textile chemist, rayon piece goods dyeing, printing, finishing. New York, New Jersey area. Will seriously consider sales. Write Box No. 928.

WANTED: DYER, for upholstery and automotive piece goods on both regular and synthetic blend work. Location —Philadelphia. Send complete resume of experience. Write Box No. 929.

POSITION WANTED: Textile Chemist wishes position with progressive finishing plant in cotton and/or synthetic field. Will be traveling eastern United States about July 1 and wishes to have interviews with interested firms. Companies who have a definite goal and training program to offer will be considered. Presently employed. Veteran and recent graduate of leading textile institute. Please give all particulars in first letter. Write Box No. 930.

Borden's

LEMOL

Polyvinyl Alcohol

Borden's Chemical Division offers industry a wide variety of polyvinyl alcohols, "LEMOLS". They can be used as emulsifiers and stabilizers . . . in adhesives . . . for paper coatings and saturants . . . for textile sizings and finishes . . . for binders . . . and for films, fibers and molded products.
The various grades of LEMOLS enable the compounder to develop these properties:

FLEXIBILITY
ULTRA-HIGH VISCOSITY
NON-JELLING
ADHESION
NON-AGEING
LIGHT STABILITY
GREASE PROOF QUALITIES
GAS PROOF QUALITIES
PROTECTIVE COLLOIDAL ACTION
HIGH PIGMENT BINDING POWER
LOW COLD WATER SOLUBILITY
HIGH COLD WATER SOLUBILITY

For further information or samples of LEMOL, write The Borden Company, Chemical Division, Monomer Dept. AD-65, Leominster, Massachusetts.

Monomer Department

THE BORDEN COMPANY

Chemical Division

New Line of

STAINLESS STEEL PAILS

at Big Savings!

New Welded Construction Equals Seamless or Spun

Entirely stainless (no solder) — smooth surfaces—sturdy 24 gauge type 304 analysis stainless—improved shape for easier carrying, better balance — handles, ears, chimes of heavy-duty stainless. Outstanding quality at lowest cost. Backed by Metalsmiths' 30 years' serving process industries.

SEND YOUR ORDER TODAY
PROMPT SHIPMENT

LOWEST PRICES — BIGGEST SELECTION ON THE MARKET

10 qt. - $9.25 ea.
12 qt. - 10.25 ea.
14 qt. - 11.25 ea.
16 qt. - 12.25 ea.
20 qt. - 13.50 ea.

Discounts in quantity

METALSMITHS

Division of Grange Roller Bearing Co., Inc.
562 White Street Orange, N. J.

NOW AVAILABLE!

NEW BINDER TO HOLD YOUR

AMERICAN DYESTUFF REPORTER COPIES

EVERY issue is held securely by flat steel blades. There is a label holder on the backbone to use for dating the volumes. Holds 26 issues. It opens flat for easy reference. Maroon leatherette with the title AMERICAN DYESTUFF REPORTER in gold leaf. It looks and handles like the finest book in your library.

Only $3.50 postpaid.

♦

Please send check with order to:

American Dyestuff Reporter

44 East 23rd Street, New York 10, N. Y.

BIXAMINE FAST BLUE 4GLL 150%

An extremely fast to light direct cotton and rayon dye recommended for Formaldehyde Urea aftertreatment

Write for sample and shade card

BICK & CO., INC.

READING, PENNA.

Wyandotte gives you quality chemicals plus technical help

Quality — that you can depend on. Close quality control assures pure and uniform chemicals. And you get prompt delivery, thanks to strategically located plants and distributor stocks.

Technical Service — saves you time in solving process problems, and helps increase your production efficiency. Wyandotte works with you on the handling and application of our products. For technical service or product data, mail coupon below. *Wyandotte Chemicals Corp., Wyandotte, Mich. Offices in principal cities.*

1 Caustic Soda — Available as: a liquid in 50% and 74% concentrations, solid, std. flake, ¼" flake, crystal, and powder.

2 PLURONICS* — Unique series of 100%-active (including flake and solid) non-ionic surfactants with molecular weights from 1,800 to 8,000. Ether-type structure results in excellent stability to acids, alkalis, electrolytes. Recommended for wool scouring, warp sizing, carbonizing, dye leveling, soaping, and finishing.

3 CARBOSE* Series — (Technical Sodium CMC) Used for warp sizing. Carbose overcomes many disadvantages of other film-forming materials. Among the *advantages* are: stability, softer warps, desizing, uniformity. More data in AATCC Yearbook.

4 Chlorine — Of the highest purity; available in 16-, 30-, and 55-ton tank cars.

5 Bicarbonate of Soda — Meets U.S.P. XIV standards. Available in several screen sizes.

6 Soda Ash — Five grades: All test 58% sodium oxide or better.

7 KREELON* — Economical surface-active agent. Comes in 40% and 85% active-agent forms; flake or powder. Retains wetting, emulsifying, detergent properties in acid, alkaline, or neutral solutions; hard or soft water.

8 PURECAL* — (ppt. $CaCO_3$) Pure, uniform; virtually free from iron, magnesium and alkali salts, abrasive materials.

* REG. U.S. PAT. OFF.

CLIP AND MAIL TODAY!

Wyandotte Chemicals Corporation, Technical Inquiry Section, Wyandotte, Mich.

Send me data on the products circled:

1 2 3 4 5 6 7 8

☐ Have your representative call on me.

Name_____

Firm_____

Address_____

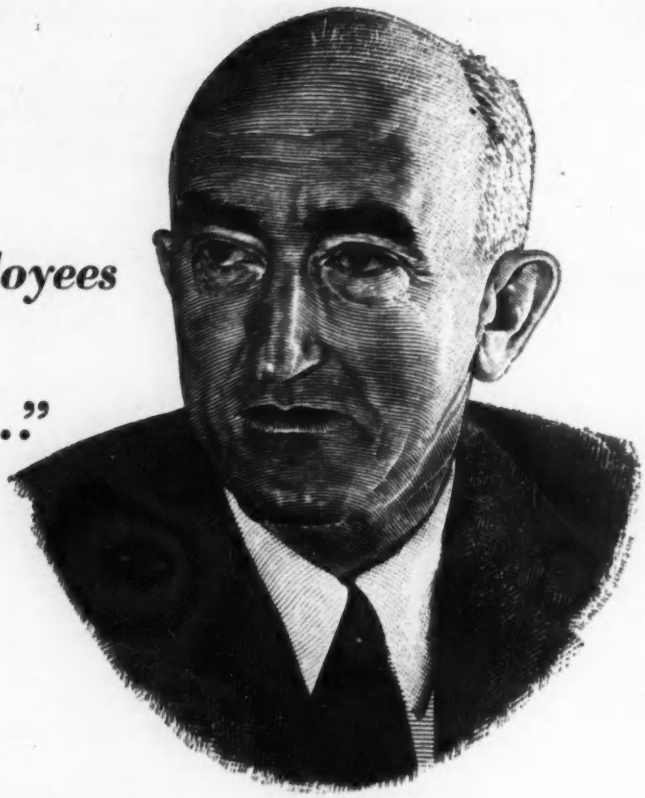
City_____

Zone_____ State_____

Wyandotte CHEMICALS

DEPENDABLE SOURCE FOR CHEMICAL RAW MATERIALS

"Boeing's 59,000 employees feel closer to the company..."



WILLIAM M. ALLEN
President
Boeing Airplane Company

"Boeing's 59,000 employees feel closer to the company since our recent successful person-to-person payroll savings drive in the Seattle and Wichita Divisions. Through letters and personal observations many employees have told us they have a greater sense of being a part of the company—that Boeing is interested in the welfare of each and every man and woman on the payroll."

That's the way it is with Payroll Savers. With the realization that systematic investment in U. S. Savings Bonds is a sure road to the down payment on a home, comfortable retirement, or other objectives, comes a better appreciation of a man's job and his company.

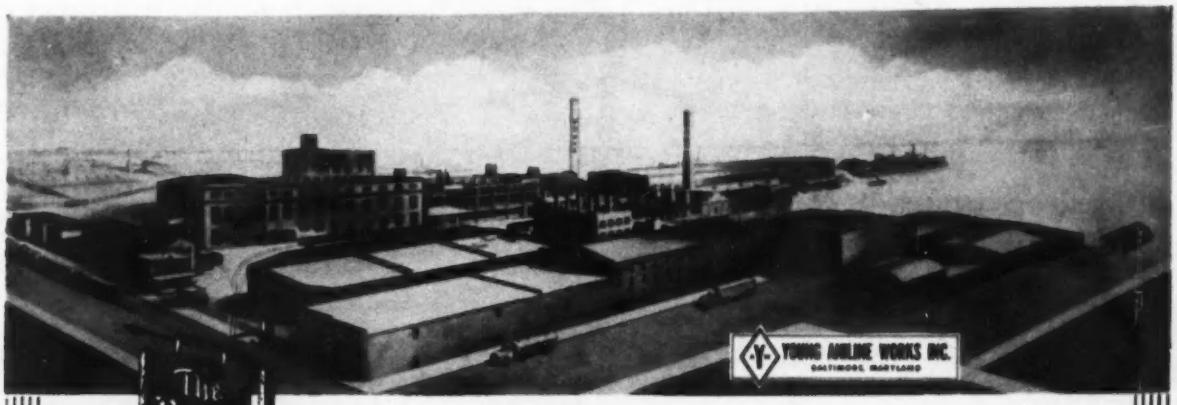
To most Payroll Savers, a day's absence from work means just that much out of his take-home savings. And he no longer takes chances, because he wants to stay off the accident list. He looks for better and quicker ways to do his job—promotion will mean more dollars for Savings Bonds. As a stockholder in America he takes a better interest in national affairs, the sound dollar, and economic stability.

91% of Boeing's 65,000 employees—more than 59,000 men and women—are Payroll Savers, as a result of a person-to-person canvass that put a Payroll Savings Blank in the hands of every Boeing employee. Certainly that is a high percentage of which Mr. Allen may well be proud. But it is not exactly unique. A number of the 45,000 companies which have the Payroll Savings Plan have 90% participation; many are in the 80% to 90% group, and many more are in the 60%, 70%, 80% class. In every case, these high percentages followed a person-to-person canvass that put a Payroll Savings Application Blank in the hands of every employee.

If less than 60% of your employees are Payroll Savers, do something about it. A phone call, telegram or letter to "Savings Bond Division, U. S. Treasury Department, Washington, D. C.," will bring prompt assistance from your State Director, U. S. Treasury Department. He will help you install, or revitalize a Payroll Savings Plan, through a simple, person-to-person canvass which your employees will be glad to conduct.

The United States Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the Advertising Council and

American Dyestuff Reporter



The House of Blacks

ACID BLACKS • DIRECT BLACKS
ACETATE BLACKS • LOGWOOD BLACKS
FORMALIDE BLACKS • DEVELOPED BLACKS

Consult your local dyestuff distributors for information and samples. Shipments can be made from their convenient stocks or from our Baltimore or Paterson warehouses.

YOUNG ANILINE WORKS, INC.
OFFICE AND FACTORY
2701-2733 Boston St., Baltimore 24, Md.

HASTINGS LIGHT FAST VIOLET IRS—(C. I. 1073)
and
HASTINGS LIGHT FAST VIOLET 3RL

Excellent Level Dyeing Properties
Very Good Fastness to Light

Recommended for producing fast shades on Ladies' Dress Goods, Carpet Yarn and Upholstery Materials.

ZINSSER & COMPANY, Inc.
Subsidiary of The Harshaw Chemical Company
ESTABLISHED 1897
Manufacturing Chemists
HASTINGS-ON-HUDSON NEW YORK

DYE "DACRON"†

Yarn • Fabrics • Blends

BELOW THE BOIL

in conventional equipment

EMKAY PROCESS*

Rexosolve — for scouring
Emkatex — for color dispersing
Emkalar — for accelerating
Rexopon — for after-washing

Brochure available giving complete details. Arrange for a demonstration at your plant. Write, wire, phone:

*Patent Pending

† Dupont's Trademark for its Polyester Fibre

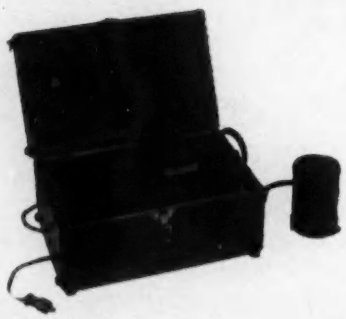
MANUFACTURING CHEMISTS EMKAY EMKA REXO

EMKAY CHEMICAL COMPANY
319-325 Second St., Elizabeth, N. J.
Elizabeth 2-7053 Elizabeth 2-7695

COLOR MATCHING

with

PHOTOVOLT Photoelectric REFLECTION METER



A truly practical precision instrument for color matching and for specifying color by tristimulus values, also for fading and detergency tests . . . for production control and laboratory work.

Portable, sturdy, simple to operate

Write for Bulletin No. 605 to:

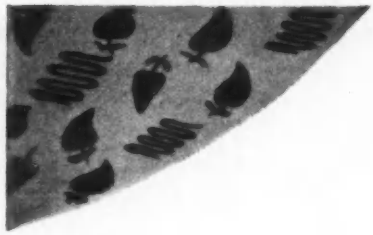
PHOTOVOLT CORP.

95 Madison Ave. New York 16, N. Y.

Also: Colorimeters, Fluorescence Meters, pH Meters

● INDEX TO ADVERTISERS ●

Alco Oil & Chemical Corp.	49A
Alliance Color & Chemical Corp.	21A
Althouse Chemical Co., Inc.	37A
Amalgamated Chemical Corp.	12A
American Aniline Products, Inc.	3A
American Cyanamid Co. (Dyestuff Dept.)	
American Cyanamid Co. (Tex. Resin Dept.)	
American Dyestuff Reporter	
American Hard Rubber Co.	
American Viscose Corp.	
Anders Chemical Co.	
Antara Chemical Division, General Aniline & Film Corp.	
Apex Chemical Co., Inc.	
Arkansas Company, The	
Armour & Co.	
Arnold Hoffman & Co., Inc.	17A
Atlantic Chemical Corp.	
Atlantic Refining Co., The	
Atlas Electric Devices Co.	
Aula Chemicals, Inc.	
Augusta Chemical Co.	
Barium Reduction Corp.	
Becco Chemical Div. Food Machinery & Chemical Corp.	
Berkshire Color and Chemical Co.	
Bick & Co., Inc.	41A
Borden Co., The, Monomer Dept., Chemical Div.	40A
Bryant Chemical Corp.	
Burkart Schier Chemical Co., Inc.	38A
Burlington Engineering Co., Inc.	
Butterworth & Sons Co., H. W.	
Calgon, Inc.	
Campbell & Co., Inc., John	4A
Carbic-Moss Corp.	34A
Carbide & Carbon Chemicals Co., A Division of Union Carbide and Carbon Corp.	48A
Charlotte Chemical Laboratories, Inc.	
Ciba Company, Inc.	11A
Colgate-Palmolive Company	
Columbia-Southern Chemical Corp.	
Cravenette Co., The	
Custom Scientific Instruments	
Demco Chemical Co.	
De Paul Chemical Co.	
Desert Sunshine Exposure Tests	
Dexter Chemical Corp.	Third Cover
Dow Chemical Co., The	
Drew & Co., Inc., E. F.	
Du Pont de Nemours & Co., (Inc.), E. I.	
Dyes and Chemical Divisions	13A
Electrochemicals Dept.	
Organic Chemicals Auxiliaries	28A
Eastman Chemicals Products, Inc.	
Emery Industries, Inc.	
Emkay Chemicals Co.	44A
Fablok Mills, Inc.	
Fancourt & Co., W. F.	
Feeley Co., E. I.	
Foxboro Co., The	
Gabb Special Products	
Gaston County Dyeing Machine Co.	
Geigy Company, Inc.	Front Cover
General Dyestuff Co.	19A
General Electric Co.	
Goodrich Chemical Company, B. F.	
Goodyear Tire & Rubber Co.	
Gurley, W. & L. E.	
Harchem Div., Wallace & Tiernan, Inc.	46A
Hart Products Corp., The	
Hercules Powder Co.	6A
Hermas Machine Co.	
Heyden Chemical Corp.	
Hilton-Davis Chemical Co., The	5A
Houghton & Co., E. F.	
Hubinger & Co., The	
Imperial Paper & Color Corp.	
Interchemical Corp., Textile Colors Div.	
International Salt Co., Inc.	20A
Jersey State Chemical Co.	



DESIZING UNIFORMITY

TIME AFTER TIME WITH

RHOZYME LA*

RHOZYME LA is the most dependable desizing enzyme now available to the textile industry.

RHOZYME LA has consistent high quality, is stable in storage, and also exhibits unusual heat resistance in high-speed, high-temperature operations.

For the full story on this low cost, highly efficient agent, write for our technical bulletin.

* **RHOZYME LA** *is another dependable chemical product for the textile industry made by the makers of* LYKOPON.

RHOZYME and LYKOPON are trade-marks, Reg. U.S. Pat. Off. and in principal foreign countries.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries

fatty acids for the textile industry

Century Brand Fatty Acids have been custom-tailored to meet the varying requirements of progressive textile processors.

Century 1405 (Distilled Animal Fatty Acid) has a light color, is odor-free, makes an excellent lubricant, and can be readily sulfated.

Century 1005 (Low Titre Distilled Oleic Acid) is easily saponified to yield an efficient, easy rinsing, sodium soap.

Century 1030 (Low Titre Double Distilled White Oleic Acid) is free from odor, discoloration and rancidity; it finds wide acceptance in emulsifiers and specialty soaps.

Century 1220 (Double Pressed Stearic Acid) is used to make cationic softeners; it gives added permanency to softening effects on cotton and rayon.

Century Hydrex 460 (Hydrogenated Fatty Acid) — Its low Iodin Value insures stability, prevents gumming and hardening when used in size softeners. Readily removable in scouring operation.

Samples and technical data available on the above products. These are but a few of the many Century Products designed for use in textile processing.

Write for a copy of our catalog today.

HARCHEM DIVISION
WALLACE & TIERNAN INC.
Successors to W. C. Hardesty Co., Inc.
25 MAIN STREET, BELLEVILLE 9, N. J.
FACTORY: Dover, Ohio. IN CANADA: W. C. HARDESTY CO. OF CANADA, LTD., TORONTO

● INDEX TO ADVERTISERS ●

Kali Mfg. Co.	
Kelco Co.	7A
Klauder Weldon Giles Machine Co.	
Laurel Soap Mfg. Co., The	16A
Le Conte & Co., Inc.	
Leatex Chemical Co.	
Mathieson Chemicals, Olin Mathieson Chemicals Corp.	33A
May, Inc., Otto B.	25A
Metalsmith Div., Orange Roller Bearing Co., Inc.	40A
Metro-Atlantic Co., Inc.	
Minneapolis-Honeywell Regulator Co., Industrial Div.	29A
Monsanto Chemical Co.	15A
Morningstar Nicol, Inc.	
Morton Salt Co.	24A
Mutual Chemical Div., Allied Chemical & Dye Corp.	
National Aniline Division, Allied Chemical & Dye Corp.	36A
National Milling & Chemical Co.	
National Starch Products	27A
Naugatuck Chemical Div., of U. S. Rubber Co.	
Nopco Chemical Corp.	
Nova Chemical Corp.	
Nyanza Color & Chemical Co., Inc.	18A
Olin Mathieson Chemicals Corp. Industrial Chemicals Div.	33A
Onyx Oil & Chemicals Co.	8A, 9A
Oronite Chemical Co.	
Pabst Sales Co.	
Pad Dye Corp.	
Pennsylvania Salt Mfg. Co.	
Perkins & Sons, Inc., B. F.	
Pfister Chemical Works, Inc.	
Pharma Chemical Corp.	34A
Philadelphia Quartz Co.	
Photovolt Corp.	44A
Pittsburgh Coke & Chemical Co.	
Procter & Gamble	
Reading Scientific Co.	
Refined Products Co.	Second Cover
Rohm & Haas Co.	
Royce Chemical Co.	Back Cover
Rumford Chemical Works	
Sandoz Chemical Works, Inc.	47A
Scholler Bros., Inc.	
Seydel-Wooley & Co.	
Sherwin-Williams Co.	
Sims Metal Works	
Sirrine Co., J. E.	
Smith, Drum & Company	
Solvay Process Division, Allied Chemical & Dye Corp.	26A
Sou-Tex Chemical Co.	
Standard Brands, Inc.	
Standard Chemical Products, Inc.	23A
Stein Hall	
Swift & Company	
Tanner Co., Charles C.	
Taylor Instrument Companies	30A
Tennessee Corporation	30A
Tex-Chem Co.	
Tinolan Co., of America, Inc.	
Union Carbide & Carbon Corp. Carbide & Chemicals Co.	48A
U. S. Rubber Co., Naugatuck Div.	
Van Vlaanderen Machine Co.	
Verona Dyestuffs	31A
Victor Chemicals	
Virginia Smelting Co.	
Wallerstein Co., Inc.	
Warwick Chemical Co.	
Westvaco Chem. Div., Food Machinery & Chemical Corp.	
Wica Chemicals, Inc.	10A
Wiesner-Rapp Co., Inc., The	
Wolf & Co., Jacques	
Wyandotte Chemicals Corp.	41A
Young Aniline Works, Inc.	43A
Zinsser & Co., Inc.	43A

New standards in light fastness

LUMICREASE COLORS

The trend is toward brighter colors, faster-to-sun, in automotive, upholstery and decorative fabrics, and LUMICREASE COLORS by Sandoz are helping to speed the trend.

The LUMICREASE line of direct colors was developed for cotton and viscose. Three of the newest and fastest colors are: LUMICREASE GREY 3LB, pat.; LUMICREASE GREEN 3LB, p.a.f.; and LUMICREASE ORANGE 3LG, pat. These have created new standards in light fastness in shades of green, tan, taupe and grey, and are unequalled by any other products on the market today.

Ask Sandoz laboratories to match your shades. Branch offices:

CHARLOTTE, N. C.
1510 Camden Road
FAIR LAWN, N. J.
Fair Lawn Ave. & Third St.
LOS ANGELES, CALIF.
467 East Third Street
MONTREAL, QUEBEC, CANADA
P.O. Box 364, Station "B"
CINCINNATI, OHIO
3712 Beechmont Ave.
HUDSON, MASS.
312 Main Street
PHILADELPHIA, PA.
2215 Tioga Street
TORONTO (Ont.) CANADA
179 King St. West

SANDOZ CHEMICAL WORKS, INC., 61 Van Dam St., New York 13, N. Y.

SANDOZ
THINKS AHEAD WITH TEXTILES

Written for You...

CARBIDE's literature is constantly revised to give you complete information on our chemicals. There are 12 family books that describe certain groups of chemicals. If you are interested in applications, physical properties, specifications, proper handling techniques, or physiological properties you will find these books of value in your work.

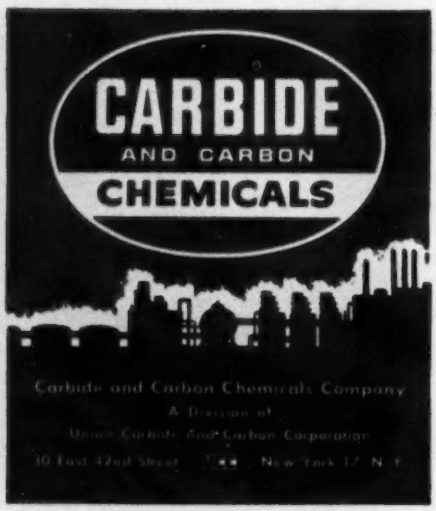
Additional data includes technical information sheets on individual chemicals and a booklet summarizing the physical properties of the more than 350 chemicals produced by CARBIDE.

CHECK THE FAMILY BOOKS YOU WANT ON THE RETURN COUPON BELOW—

They will be sent to you promptly!

1. Alcohols
2. Aldehydes
3. Aliphatic Nitrogen Compounds
4. CARBOWAX Polyethylene Glycols
5. CELLOSOLVE and CARBITOL Solvents
6. Esters
7. Ethers and Oxides
8. FLEXOL Plasticizers, 3rd Edition
9. Ketones
10. Organic Acids
11. Organic Chlorine Compounds
12. Emulsions and Detergents, 9th Edition
13. 1955 Edition Physical Properties of Synthetic Organic Chemicals

In Canada: Carbide Chemicals Company,
Division of Union Carbide Canada Limited, Toronto



"Carbowax," "Carbitol," "Cellosolve," and "Flexol" are registered trade-marks of Union Carbide and Carbon Corporation.

CARBIDE AND CARBON CHEMICALS COMPANY
Room 308, 30 East 42nd Street, New York 17, N. Y.

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐

Name.....

Company.....

Address.....

City.....State.....

I am also interested in additional information on:.....

.....

The Modern Cotton Softener

Dexene 77 is the newest, the most advanced way to put softness back into cotton. With Dexene 77, cotton never had it so soft!

Gives full-bodied, rich softness to cotton fibers.
Resists oxidation and rancidity.
Has excellent moisture retaining qualities.
Has no effect on light fastness of dyes.
Does not produce tackiness or mark-off.
Facilitates high-speed sewing and cutting.
Highly economical—only a small percentage is necessary to obtain an excellent hand.

your touch tells you . . . DEXENE 77*

dexter

Textile Chemicals

* TRADEMARK

TEXTILE CHEMICAL DIVISION OF DEXTER CHEMICAL CORP., NEW YORK 59, N. Y.
Boston • Charlotte • Atlanta • Greensboro • Buenos Aires

liquid desizers ?
take your choice...
the best are **NEOZYMES**
-made by
ROYCE

NEOZYME® L

- **HIGH CONCENTRATION...** halves standard storage space and costs

NEOZYME® Special

- **STANDARD STRENGTH...** for general application

- **SUPERIOR HEAT STABILITY...** at 160° F—better than other liquid commercial enzymes.
- **RESERVE POTENCY...** addition of common salt increases bath potency... and saves **NEOZYME!**
- **CONTROLLED QUALITY...** strict Royce laboratory control guarantees safe, stable, uniform products.
- **COMPLETE SERVICE...** the Royce Technical Service—with years of experience — always available to help solve your desizing problems.

Write today. We'll send you full information and data sheets on either or both liquid NEOZYMES.

Prefer a powdered desizer?
Ask for data on powdered NEOZYME and NEOZYME HT.

ROYCE CHEMICAL CO.

Royce

CHEMICAL COMPANY • CARLTON HILL, NEW JERSEY
Manufacturers of Chemicals for the Textile Industry